PACiS GTW

Gateway

GTW/EN O/C80

Operation Guide

Schneider Electric

PACiS GTW GATEWAY CONTENT

Safety & Handling	**GTW/EN SA/C80**
Technical Data	**GTW/EN TD/C80**
Introduction	**GTW/EN IT/C80**
Hardware Description	**GTW/EN HW/C80**
Application	**GTW/EN AP/C80**
Functional Description	**GTW/EN FT/C80**
Lexicon	**GTW/EN LX/C80**

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SAFETY & HANDLING

CONTENT

1.	**INTRODUCTION**	**3**
2.	**SAFETY**	**4**
2.1	**Health and Safety**	**4**
2.2	**Explanation of symbols and labels**	**4**
2.3	**Installing, Commissioning and Servicing**	**4**
2.4	**Decommissioning and Disposal**	**4**
3.	**GUARANTEES**	**5**
4.	**COPYRIGHTS & TRADEMARKS**	**6**
4.1	**Copyrights**	**6**
4.2	**Trademarks**	**6**
5.	**WARNINGS REGARDING USE OF SCHNEIDER ELECTRIC PRODUCTS**	**7**

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1. INTRODUCTION

The present document is a chapter of the PACiS GTW gateway documentation. It describes the safety, handling, packing and unpacking procedures applicable to PACiS GTW gateway software tools.

2. SAFETY

WARNING: THIS SAFETY SECTION SHOULD BE READ BEFORE COMMENCING ANY WORK ON THE EQUIPMENT.

2.1 Health and Safety

The information in the Safety Section of the product documentation is intended to ensure that products are properly installed and handled in order to maintain them in a safe condition. It is assumed that everyone who will be associated with the equipment will be familiar with the contents of the Safety Section and all Safety documents related to the PC and Communication networks.

2.2 Explanation of symbols and labels

The meaning of symbols and labels may be used on the equipment or in the product documentation, is given below.

2.3 Installing, Commissioning and Servicing

Equipment operating conditions

The equipment (PC and communication network supporting PACiS GTW gateway) should be operated within the specified electrical and environmental limits.

Fibre optic communication

Optical LED transceivers used in Switch boards are classified as IEC 825-1 Accessible Emission Limit (AEL) Class 1 and consequently considered eye safe.

Optical power meters should be used to determine the operation or signal level of the device.

2.4 Decommissioning and Disposal

Disposal:

It is recommended to avoid incineration and disposal of the PC and the communication network supporting PACiS GTW gateways. The products should be disposed of in a safe manner.

3. GUARANTEES

The media on which you received Schneider Electric software are guaranteed not to fail executing programming instructions, due to defects in materials and workmanship, for a period of 90 days from date of shipment, as evidenced by receipts or other documentation. Schneider Electric will, at its option, repair or replace software media that do net execute programming instructions if Schneider Electric receive notice of such defects during the guaranty period. Schneider Electric does not guaranty that the operation of the software shall be uninterrupted or error free.

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In any application, including the above reliability of operation of the software products can be impaired by adverse factors, including -but not limited- to fluctuations in electrical power supply, computer hardware malfunctions, computer operating system, software fitness, fitness of compilers and development software used to develop an application, installation errors, software and hardware compatibility problems, malfunctions or failures of electronic monitoring or control devices, transient failures of electronic systems (hardware and/or software), unanticipated uses or misuses, or errors from the user or applications designer (adverse factors such as these are collectively termed "System failures").

Any application where a system failure would create a risk of harm to property or persons (including the risk of bodily injuries and death) should not be reliant solely upon one form of electronic system due to the risk of system failure to avoid damage, injury or death, the user or application designer must take reasonably steps to protect against system failure, including -but not limited- to back-up or shut-down mechanisms, not because end-user system is customised and differs from Schneider Electric ' testing platforms but also a user or application designer may use Schneider Electric products in combination with other products.

These actions cannot be evaluated or contemplated by Schneider Electric; Thus, the user or application designer is ultimately responsible for verifying and validating the suitability of Schneider Electric products whenever they are incorporated in a system or application, even without limitation of the appropriate design, process and safety levels of such system or application.

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TECHNICAL DATA

CONTENT

1.	**INTRODUCTION**	**3**
1.1	**General features**	**3**
2.	**INDUSTRIAL PC CHARACTERISTICS**	**4**
2.1	**Operating System**	**4**
2.2	**Configuration**	**4**
2.3	**Communication ports with SCADA**	**4**
2.4	**Ethernet Communication port**	**4**
2.5	**Rated Values**	**4**
2.6	**DC auxiliary supply**	**5**
2.7	**AC auxiliary supply**	**5**
2.8	**Insulation**	**5**
2.9	**Environmental**	**6**
2.10	**Mechanical**	**6**
2.11	**Safety**	**6**
2.12	**EMC TESTS**	**7**
2.13	**Wiring**	**8**
3.	**NON-ROTATING PART EMBEDDED PC CHARACTERISTICS**	**9**
3.1	**Operating system**	**9**
3.2	**Configuration**	**9**
3.3	**Communication ports with SCADA**	**9**
3.4	**Mechanical**	**9**
3.5	**Power Supply**	**10**
3.6	**Environment Specifications**	**10**
3.7	**Wiring**	**10**
3.7.1	Serial connection	10
3.7.2	Ethernet connection	10
4.	**SOFTWARE GATEWAY CHARACTERISTICS**	**11**
4.1	**Number of Data Points**	**11**
4.2	**Response time**	**11**
4.3	**SBUS Avalanche**	**11**
4.4	**Exchanging message with SCADA**	**11**
4.5	**SBUS acquisition**	**11**
4.6	**Time specifications**	**11**
4.7	**ISaGRAF 5.21**	**11**

5. GI74 CHARACTERITICS 12

5.1 Operating System 12

5.2 Configuration 12

5.3 Communication ports with SCADA 12

6. SYSTEM DEPENDABILITY 13

6.1 MTBF 13

6.2 Availability 13

1. INTRODUCTION

This document is a chapter of the PACiS GTW gateway documentation. It is the chapter Technical Data (TD) of this Product.

PACiS GTW gateway is a software package installed on an industrial PC or on a Non-rotating part Embedded PC to increase environmental capabilities. Technical characteristics of these PCs are described thereafter.

The GI74 protocol is implemented on a specific platform based also on an industrial PC described thereafter.

For more information about hardware description see chapter HW. For more information about connection diagrams see chapter CO.

1.1 General features

A PACiS GTW gateway can manage up to 4 protocols and up to 8 channels.

Different kinds of links are available (list is not limited to the ones given):

- PSTN MODEM (external device)
- Radio link through MODEM
- Ethernet

Features	Limit
Number of devices (IEC61850 equipment - Legacy Bus equipment: C264, HMI, GTW, IED)	256
Binary inputs (SP, DP, SI, 1 among N)	5048/device
Measurements	512/ device
Counters	64/ device
Output controls	1024 /device
Setpoints outputs (binary and analogue)	512 /device

TABLEAU 1: GENERAL FEATURES

2. INDUSTRIAL PC CHARACTERISTICS

2.1 Operating System

Gateway software is intended to run under an industrial PC running under Windows 2003 Server, Windows XP or Windows XP Embedded operating system with at least 256 Mo of RAM.

Using 256 Mo of RAM you will not need a swap memory i.e. the gateway and the system will run in RAM.

2.2 Configuration

The configuration of the gateway is given in table 1 of chapter GTW/EN HW. This configuration complies with the environmental constraints given hereafter.

2.3 Communication ports with SCADA

- Number of simultaneous protocols: 4
- Number of serial ports by protocol: 2 (main, redundant)
- Thus 8 ports maximum on one gateway: 2 cards with 4 ports
- Number of communication ports: 8 at the most, set by PACiS SCE
- Baud rate (bits/s): from 100 to 38400, set by PACiS SCE

The motherboard has 2 serial communication ports. You can use them for one communication with SCADA plus a redundant port or 2 communications with SCADA. For additional communication ports , add a PCI or an ISA communication card into the PC.

2.4 Ethernet Communication port

The Ethernet communication port is a 10 / 100 Mbps RJ45 connector.

2.5 Rated Values

TEST	INTERNATIONAL STANDARD	Harmonised
Rated Auxiliary Voltage DC	IEC 60255-6	Minimum requirement 48 VDC, 110/125 VDC, 220/250 VDC
Rated Frequency	IEC 60255-6	50 or 60 Hz.
Rated AC Voltage	No Standard	84 à 240 VAC

2.6 DC auxiliary supply

TEST	INTERNATIONAL STANDARD	Harmonised
Supply variations	IEC 60255-6	Vn +/- 20% Vn + 30% & Vn - 25% for information
Ramp down to zero	/	From Vn down to 0 within 1mn From Vn down to 0 within 100mn
Ramp up from zero	/	From 0 up to Vn within 1mn From 0 up to Vn within 100mn
Supply interruption	IEC 60255-11	From 2ms to 100ms at 0,88Vn
40s interruption	IEC 60255-11	/
Reverse polarity	/	Continuous withstand
Ripple (frequency fluctuations)	IEC 60255-11	12% x Vn AC ripple, frequency = 100Hz or 120Hz 12% x Vn AC ripple, frequency = 200Hz for information

2.7 AC auxiliary supply

TEST	INTERNATIONAL STANDARD	Harmonised
Supply variations	IEC 60255-6	Vn +/- 20%
Dips & Short interruptions	IEC 61000-4-11	2ms to 20ms 50ms to 1s
Frequency fluctuations	IEC 60255-6	From 44 to 55Hz
Harmonics Immunity	IEC 61000-4-7	5% over the range 2^{nd} to 17^{th}

2.8 Insulation

TEST	INTERNATIONAL STANDARD	Harmonised
Dielectric	IEC 60255-5: 2000	2KV, 50Hz, 1mn CM
	IEEE C37.90.1: 1989	2KV, 50Hz, 1mn CM 1KV, 50Hz, 1mn DM
Insulation Resistance	IEC 60255-5: 2000	>100MΩ at 500VDC
HV Impulse	IEC 60255-5: 2000	Class 1: 5KV, 1.2/50μs, 0.5J, 500Ω CM on power supplies 3KV, 1.2/50μs, 0.5J, 500Ω DM on power supplies
		Class 1: 1KV, 1.2/50μs, 0.5J, 500Ω CM on communications

2.9 Environmental

TEST	INTERNATIONAL STANDARD	Harmonised
Cold Operating	IEC 60068-2-1	Test Ad: -10°C, 96h
Cold Storage	IEC 60068-2-1	Test Ad: -40°C, 96h
Dry Heat Operating	IEC 60068-2-2	Test Bd: +40°C, 96h, accurate +55°C, 2h, errors acceptable
Dry Heat Storage	IEC 60068-2-2	Test Bd: +70°C, 96h
Damp Heat Operating	IEC 60068-2-3	Test Ca: +40°C, 10 days, 93% RH
	IEC 60068-2-30	+25°C to +55°C, 93% RH, 3 cycles of 24h

2.10 Mechanical

TEST	INTERNATIONAL STANDARD	Harmonised
Vibration response (energised)	IEC 60255-21-1	Class 1
Vibration endurance (non-energised)	IEC 60255-21-1	Class 1
Shock response (energised)	IEC 60255-21-2	Class 1
Bump (non-energised)	IEC 60255-21-2	Class 1: 10g, 16ms, 2000/axis
Seismic (energised)	IEC 60255-21-3	Class 1
Drop		
no packaging	IEC 60068-2-31	Test Ec: 2 drops from 50mm corner drop, and topple test
with packaging	IEC 60068-2-32	Test Ed: 2 drops from 0.5m on each face, edge and corner

2.11 Safety

TEST	INTERNATIONAL STANDARD	Harmonised
Product Safety	CAPIEL draft Product Safety document under preparation	CE mark conformity

2.12 EMC TESTS

TEST	INTERNATIONAL STANDARD	Harmonised
Electrostatic Discharge	IEC 61000-4-2	Cover on: Class III: 8KV air discharge 6KV contact discharge
RFI Immunity-radiated	IEC 61000-4-3	Class III: 10V/m, 80 to 1000MHz Modulation: 1KHz, 80% Polarisation H & V
	ENV 50204	10V/m, 900 to 1800MHz Modulation: 50%
Fast Transient Burst	IEC 61000-4-4	Class IV on power supply: 4KV, 2.5KHz
		Class III on communications: 2KV, 5KHz
Surge Immunity	IEC 61000-4-5	Level 3 on power supply: 2KV CM / 1KV DM
		Level 3 on communication: 2KV CM
Conducted RFI Immunity	IEC 61000-4-6	10Vrms, 150KHz to 80MHz
Power Frequency Magnetic Field Immunity	IEC 61000-4-8	30A/m continuous
Damped Oscillatory Magnetic Field Immunity	IEC 61000-4-10	10A/m
High Frequency Disturbance	IEC 61000-4-12	Class III on power supply: 2.5KV CM / 1KV DM 1MHz, 400 bursts/s & 100KHz, 50 bursts/s
		Class II n communications: 1KV CM / 0,5KV DM
RFI Emissions		
Conducted Emissions	IEC 60255-25	Class A: 0.15 to 30MHz: 0.15 to 0.5MHz: 79dBμV quasi peak 0.5 to 30MHz: 73dBμV quasi peak
Radiated Emissions	IEC 60255-25	Class A: 30 to 1000MHz: 30dBμV/m at 30m or 40dBμV/m at 10m

2.13 Wiring

The connection with the PACiS GTW gateway is full compatible with standard RS232C.

A SCADA communication can be establish on one serial port. One more serial port is needed for redundancy.

A Null-Modem cable can be connected to a SCADA simulator or a Network Analyser.

For more information about the connection see the chapter CO.

3. NON-ROTATING PART EMBEDDED PC CHARACTERISTICS

3.1 Operating system

Gateway software is intended to run under a dedicated non-rotating part Embedded PC with the following characteristics:

- Model: ADVANTECH UNO-3074 fanless Embedded Box Computer
- Processor: M 1.4/1.8 GHz
- Memory: 1 GB DDR SDRAM
- 24 V Power Supply.
- **OS Support** Windows XP embedded

3.2 Configuration

The configuration of the gateway is given in chapter GTW/EN HW. This configuration complies with the environmental constraints given hereafter.

3.3 Communication ports with SCADA

- **Clock** Battery-backup RTC for time and date
- **LAN** 2 x 10/100Base-T RJ-45 ports (Built-in boot ROM in flash BIOS)
- **Serial Ports** 2 x RS-232, 2 x RS-232/422/485 with DB9 connectors Automatic RS-485 data flow control
- **Serial Port Speed** RS-232: 50 bps ~ 115.2 kbps RS-422/485: 50 bps ~ 921.6 kbps (Max.)
- **USB Ports** 4 x USB, USB EHCI, Rev. 2.0 compliant
- Digital Inputs (4-ch. wet contact DI0 ~ DI3)

  - 2,000 VDC isolation
  - 50 ~ 70 VDC over-voltage protection
  - ±50 VDC input range and 10 kHz speed
  - Interrupt handling speed: 10 kHz

- Digital Outputs (4 ch. DO0 ~ DO3)

  - 2,000 VDC isolation and 200 mA max/channel sink current
  - Keep output status after system hot reset
  - 0 ~ 40 VDC output range and 10 kHz speed

- Counters/Timers (2 x 16-bit)

  - Counter source: DI1 & DI3, Pulse output: DO2 & DO3
  - Can be cascaded as one 32-bit counter/timer
  - Down counting, preset counting value
  - Timer time base: 100 kHz, 10 kHz, 1 kHz, 100 Hz

In the ADVANTECH PC configuration described below the PC has four serial communication ports and 2 Ethernet communication ports. You can use them for one communication with SCADA plus a redundant port or two communications with SCADA.

3.4 Mechanical

Construction	Aluminum housing
Mounting	Wall/Panel/Stand
Dimensions (W x H x D)	193 x 237 x 179 mm (7.6" x 9.3" x 7.0" for UNO-3074)
Weight	7 kg

3.5 Power Supply

Output Rating	24 W (typical, no PCI cards)
Input Voltage	9 ~ 36 VDC (e.g. +24 V @ 2 A) (Max. 5A), AT. (16 ~ 36 VDC for 12 V PCI boards)

3.6 Environment Specifications

Operating Temperature	-20 ~ 55° C (-4 ~ 131° F) @ 5 ~ 85% RH (with CF card)
Relative Humidity	95% @ 40° C (non-condensing)
Vibration Loading	IEC 68 2-64 (Random 1 Oct./min, 1hr/axis.) CompactFlash: 2 Grms @ 5 ~ 500 Hz HDD: 1 Grms @ 5 ~ 500 Hz
Shock During Operation	IEC 68 2-27 CompactFlash: 50 G @ wall mount, half sine, 11 ms HDD: 20 G @ wall mount, half sine, 11ms
EMC Approved	CE, FCC class A, UL, CCC
Safety Approved	UL

3.7 Wiring

3.7.1 Serial connection

The connection with the PACiS GTW gateway is full compatible with standard RS 232/422/485 (Two RS-232 & two RS-232/422/485 ports with RS-485 automatic flow control).

COM1 and COM2 are compatible with standard RS-232 serial communication interface ports.

COM3 and COM4 are compatible with standard RS-232/422/485 serial communication interface ports. The default setting for COM3 and COM4 is for RS422/485

A SCADA communication can be established on one serial port. One more serial port is needed for redundancy.

A Null-Modem cable can be connected to a SCADA simulator or a Network Analyser.

For more information about the connection see the chapter CO.

3.7.2 Ethernet connection

The connection with the PACiS GTW gateway is full compatible with standard 10/100 Mbps RJ45.

A SCADA communication can be establish on one Ethernet port. One more Ethernet port is needed for redundancy.

A crossover Ethernet cable can be connected to a SCADA simulator or a Network Analyser.

For more information about the connection see the chapter CO.

4. SOFTWARE GATEWAY CHARACTERISTICS

4.1 Number of Data Points

Refer to § 1.1.

4.2 Response time

Time to receive a response after sending a request: 100ms

4.3 SBUS Avalanche

The linked list that manage events can memorise 15 000 events by protocol process.

4.4 Exchanging message with SCADA

Response time to a SCADA request after the parameter settings phase for the parameters, synchronisation pre and post transmission times:

less than 30 milliseconds regardless of the protocol

4.5 SBUS acquisition

The gateway can support avalanche of events without loss during a short period of time.

4.6 Time specifications

Operations	Gateway
Time between DI change of state at bay computer and gateway reception	500 ms
Time between AI change of value at bay computer and gateway reception	sampling period + 1 s
Time between gateway control initiation and DO activation	750 ms

TABLEAU 2: TIME SPECIFICATIONS

4.7 ISaGRAF 5.21

Function No.	Typical maximum values
Programs	160
Functions	100
Function blocks	300
Variables	5000 (all except datapoints)
Datapoints	3000
Simultaneous resources on non redundant GTW-Isa	8
Simultaneous resources on redundant GTW-Isa	8

Resource cycle time nominal: 100 ms

5. GI74 CHARACTERITICS

5.1 Operating System

The GI74 software is intended to run under the below described industrial PC only running under VxWorks with a specific communication board (BCOM8+).

5.2 Configuration

The industrial PC where the GI74 is running has the following configuration

Reference	Designation
2070368A07	GI74 Supply 48VDC and filter
2070368A08	GI74 Supply 110VDC and filter
2070368A09	GI74 Supply 220VAC and filter
9565913	Serial board BCOM8 (from ASE)

INDUSTRIAL PC base version
Rack Schneider Electric GI74
CPU TEKNOR PCI 946/P3-700
Memory 128 Mo PC100 SDRAM
FDP PICMG PCI-7S version G1
Flash disk IDE 16 Mo
Cable Flash disk + adapter
Floppy driver 3,5”
Cable Floppy
Board reprise unpopulated
Cable LED
Cables COM1/COM2

TABLEAU 3: GI74 CONFIGURATION

5.3 Communication ports with SCADA

A dedicated communication card assumes communication with SCADA: BCOM8+.

This card can manage up to four communication ports.

Baud rates: 300 to 2400

6. SYSTEM DEPENDABILITY

6.1 MTBF

Device	MTBF
Industrial PC Gateway	50 000h
Non rotating part embedded PC Gateway	72 000h

TABLEAU 4: MTBF

6.2 Availability

Device	MTTR (in minutes)
Industrial PC Gateway	30 to 60
Non rotating part embedded PC Gateway	14 to 16

TABLEAU 5: AVAILABILITY

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INTRODUCTION

CONTENT

1.	**INTRODUCTION**	**3**
2.	**INTRODUCTION TO PACiS GTW GATEWAYS' GUIDES**	**4**
2.1	**Chapters description**	**4**
2.1.1	Safety Chapter (SA)	4
2.1.2	Introduction Chapter (IT)	4
2.1.3	Functional Description Chapter (FT)	4
2.1.4	Technical Data Chapter (TD)	4
2.1.5	Communications Chapter (CT)	4
2.1.6	HMI, Local control and user interface Chapter (HI)	4
2.1.7	Installation Chapter (IN)	4
2.1.8	Hardware Description Chapter (HW)	4
2.1.9	Connection diagrams Chapter (CO)	4
2.1.10	Commissioning Chapter (CM)	4
2.1.11	Record Sheet Chapter (RS)	5
2.1.12	Applications Chapter (AP)	5
2.1.13	Maintenance, Fault finding, Repairs Chapter (MF)	5
2.1.14	Lexicon Chapter (LX)	5
2.1.15	Problem Analysis Chapter (PR)	5
2.1.16	Logic Diagrams Chapter (LG)	5
2.2	**Operation guide**	**5**
2.3	**Technical guide**	**5**
2.4	**Extra information**	**5**
3.	**INTRODUCTION TO PACiS**	**6**
3.1	**What are PACiS Products?**	**6**
3.2	**Application and Scope**	**6**
3.3	**Gateway environment**	**7**

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1. INTRODUCTION

The present document is a chapter of the PACiS GTW Gateway documentation. It describes the documentation’s chapters you can find in the different guides, the types of applications and how to use the product. It is the Introduction (IT) chapter of this Product's manual.

2. INTRODUCTION TO PACiS GTW GATEWAYS' GUIDES

This version of the PACiS GTW documentation refers to version PACiS V4.8. The guides provide functional and technical descriptions of the product and of a comprehensive set of functions for the product's use and applications.

PACiS GTW Gateways guides are divided into two volumes, as follows:

- Operation Guide: includes information on the application of the product and a technical description of its features. It is mostly intended for engineers involved in the selection and application of the product.
- Technical Guide: contains information on the installation and commissioning of the product, and also a fault finding section. This volume is intended for site engineers who are responsible for the installation and commissioning of the product.

2.1 Chapters description

2.1.1 Safety Chapter (SA)

This chapter contains the safety instructions, handling and reception of electronic equipment, packing and unpacking of parts, Copyrights and Trademarks.

2.1.2 Introduction Chapter (IT)

This is the present document, it contains the description of each chapter of the PACiS GTW Gateway guides. It presents a brief introduction to PACiS GTW Gateways capabilities.

2.1.3 Functional Description Chapter (FT)

This chapter contains a description of the product. It describes the functions of the PACiS GTW Gateway.

2.1.4 Technical Data Chapter (TD)

This chapter contains technical data, including accuracy limits, recommended operating conditions, ratings and performance data. It also lists environment specification, compliance with technical standards.

2.1.5 Communications Chapter (CT)

This chapter provides detailed information on the communication interfaces of the product, i.e. it gives the profiles of the implemented protocols.

2.1.6 HMI, Local control and user interface Chapter (HI)

This chapter contains the operator interface description, Menu tree organisation and browsing, description of LEDs and Setting/configuration software.

2.1.7 Installation Chapter (IN)

This chapter contains the installation procedures.

2.1.8 Hardware Description Chapter (HW)

This chapter contains the hardware product description.

2.1.9 Connection diagrams Chapter (CO)

This chapter contains the external wiring connections.

2.1.10 Commissioning Chapter (CM)

This chapter contains instructions on how to commission the product, including setting and functionality checks of the product.

2.1.11 Record Sheet Chapter (RS)

This chapter contains record sheet to follow the maintenance of the PACiS GTW Gateway product.

2.1.12 Applications Chapter (AP)

This chapter gives a comprehensive and detailed description of the features of the PACiS GTW Gateways product. This chapter includes a description of common system applications of the PACiS GTW Gateway, practical examples on how to perform certain basic functions, suitable settings, a few typical worked examples and information on how to apply the settings to the product.

2.1.13 Maintenance, Fault finding, Repairs Chapter (MF)

This chapter advises on how to recognise failure modes, fault codes and describes the recommended actions for repair.

2.1.14 Lexicon Chapter (LX)

This chapter contains lexical description of acronyms and definitions.

2.1.15 Problem Analysis Chapter (PR)

This chapter contains identification and resolution of the main problems which can occurs on the PACiS GTW Gateway.

2.1.16 Logic Diagrams Chapter (LG)

This chapter contains logic diagrams of the PACiS GTW Gateway.

2.2 Operation guide

This binder contains the following chapters: SA, TD, IT, HW, AP, FT, LX.

2.3 Technical guide

This binder contains the following chapters: SA, TD, IT, HW, CO, IN, HI, CT, CM, RS, , PR, FT, LG, LX.

2.4 Extra information

Ask for Chapter MF.

3. INTRODUCTION TO PACiS

Schneider Electric philosophy is to provide a full range of products, computers, gateways and IEDs products. Each of these products can be used independently, or can be integrated to form a PACiS system: a Digital Control System (DCS) SCADA system.

3.1 What are PACiS Products?

Driven by worldwide requirements for advanced applications in SCADA, Digital Control Systems, Automation, control and monitoring, Schneider Electric have designed and developed a new and comprehensive system: PACiS, specifically intended for the power process environment and electrical utility industry. It allows building of a customised solution for Control, Monitoring, Measurement and Automation of electrical processes.

This new generation of products has been specially tailored for the PACiS system. A major objective for PACiS products is to make this range as easy as possible for the customer to accept, adapt and integrate into their system and operation.

One of the key features is that this product family is based on a IEC61850 client/server architecture.

3.2 Application and Scope

The Telecontrol Gateway (GTW) is the PACiS control system's gateway. It provides the system with a connection to a Remote Control Point (RCP), located in a dispatching centre (SCADA), thus allowing the dispatcher to perform remote control and monitoring of the system from the SCADA.

Main functions of the gateway are:

- Transmission of remote indications from the system to the control centre.
- Transmission of remote measurements from the system to the control centre.
- Transmission of commands to the system, issued from the remote control centre.

GTW and RCP communicate together by data exchanges based on a specific communication protocol. The TGW label describes in fact a range of bridges, each supporting a protocol dedicated to a specific remote control type.

The communication with the SCADA uses a RS232 or Ethernet links.

The TG may be redundant in the PACiS system in order to ensure the quality of service in case of a communication failure. Moreover, it should be multi-protocol, this means it has to manage several different protocols in order to communicate with several different SCADAs.

A standardised protocol is used in accordance with the choice of each project's SCADA supplier.

3.3 Gateway environment

The PACiS GTW Gateway is a dedicated device (PC TYPE): do not confuse it with the remote control interface function which may be included in the MiCOM C264 computers.

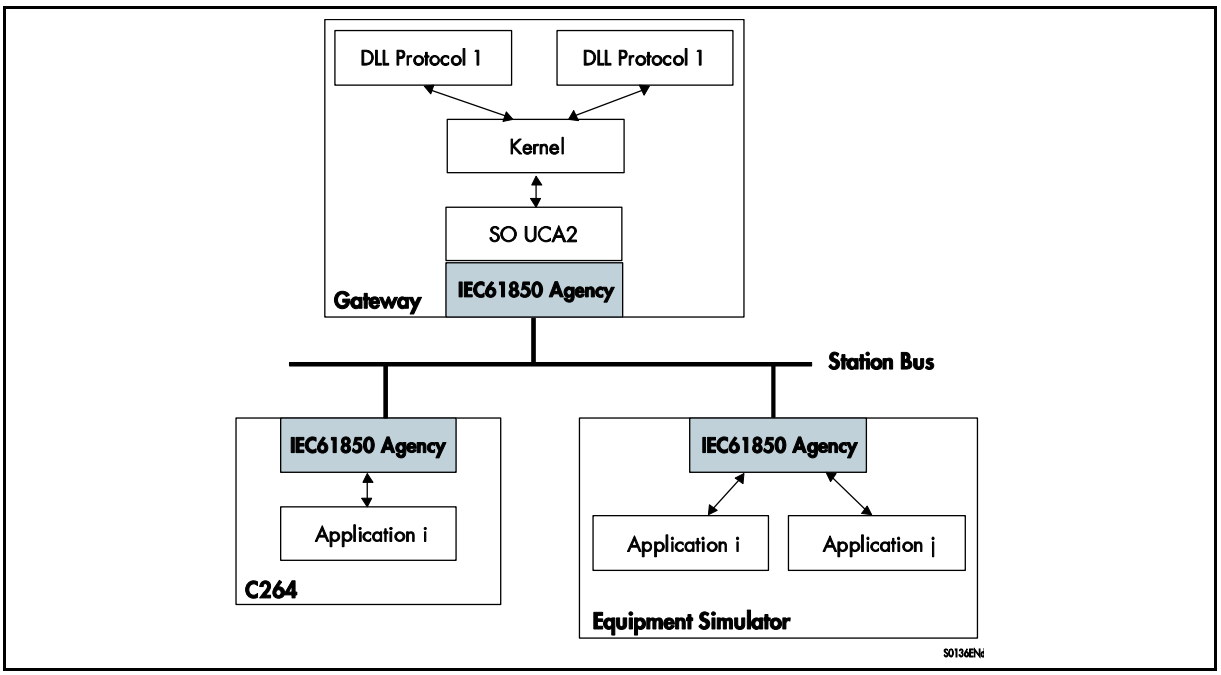

FIGURE 1: PACiS GTW GATEWAY ENVIRONMENT

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HARDWARE DESCRIPTION

CONTENT

1.	**INTRODUCTION**	**3**
2.	**INDUSTRIAL PC DESCRIPTION**	**4**
2.1	**Main features**	**4**
2.2	**Description**	**5**
2.2.1	Dimensions	5
2.2.2	Front panel	5
2.2.3	Rear panel	6
2.2.4	Power supply	6
2.3	**Communication**	**6**
3.	**NON-ROTATING PART EMBEDDED PC MiCOM A300 DESCRIPTION**	**7**
3.1	**Main features**	**7**
3.2	**Front and rear view dimentions for MiCOM A300 Panel External I/O**	**8**
3.3	**Rear Panel External I/O for MiCOM A300**	**8**

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1. INTRODUCTION

This document is a chapter of the PACiS GTW gateway documentation. It is the chapter Hardware Description (HW) of this Product.

The gateway may be either an industrial PC or a Non-rotating part Embedded PC.

To get further details about the PC hardware, refer to the User's Manual supplied with the industrial PC or with the Non-rotating part Embedded PC.

2. INDUSTRIAL PC DESCRIPTION

2.1 Main features

To increase environmental capabilities, an industrial PC may be used. It is a steel rugged chassis specially designed to work under harsh environment for high reliability application.

The hardware description of this PC configuration is done hereafter.

This PC is equipped with the following modules:

Reference	Designation	
9566085B3	Chassis	4U Rackmount Mother Board Chassis (Black)
	Power Supply	400W A TX/PFC Auto-Switching Power Supply
	Floppy Disk Reader	3.5" 1.44 MB Floppy Disk Drive (Black)
	DVD	DVD R/W Drive: 20X IDE DVD+/-RW Drive (Black)
	Fan Filter	Fan Filter
	Door Filter	Door Filter
	Cooler	LGA775 CPU cooler
	Mother Board	LGA775 Core™2 Duo/Pentium® 4 Industrial ATX MB FSB 1066 MHz with Single Gigabit LAN
	Processor	Intel® Core™2 Duo E6700 processor LGA775 2.66 Ghz/4MB L2 cache 1066 MHz/FSB
	MEMORY DDR2	Dual Channel DDR2-667 MHz 4 GB (4 x 1 GB) non-ECC non-Register 240-Pin
	Hard disk	HDD: 2xSerial-ATA 3.5", SEAGATE, 160 GB, 7200 RPM
	RAID	RAID Card: PROMISE RAID 5 CARD SATA 24 CH PCI (G) - SATA II RAID Controller card, with 2-SATA ports, 128 MB DDR2 533 RAM, PCIex4
	LAN/NIC	Additional NIC Card: Dlink / Intel Network Card 10/100/1000 M PCI Slot
	Keyboard	Microsoft® USB 104 Key Keyboard (Black)
	Mouse	Microsoft® 3-Button USB Optical Mouse (Black)
	Operating System	Microsoft® Windows XP Professional SP3 OEM
	Test	IPC System Installation and 8-hour burn-in-test included

TABLEAU 1: INDUSTRIAL PC SPECIFICATION

2.2 Description

2.2.1 Dimensions

431mm x 413.5mm x 176mm

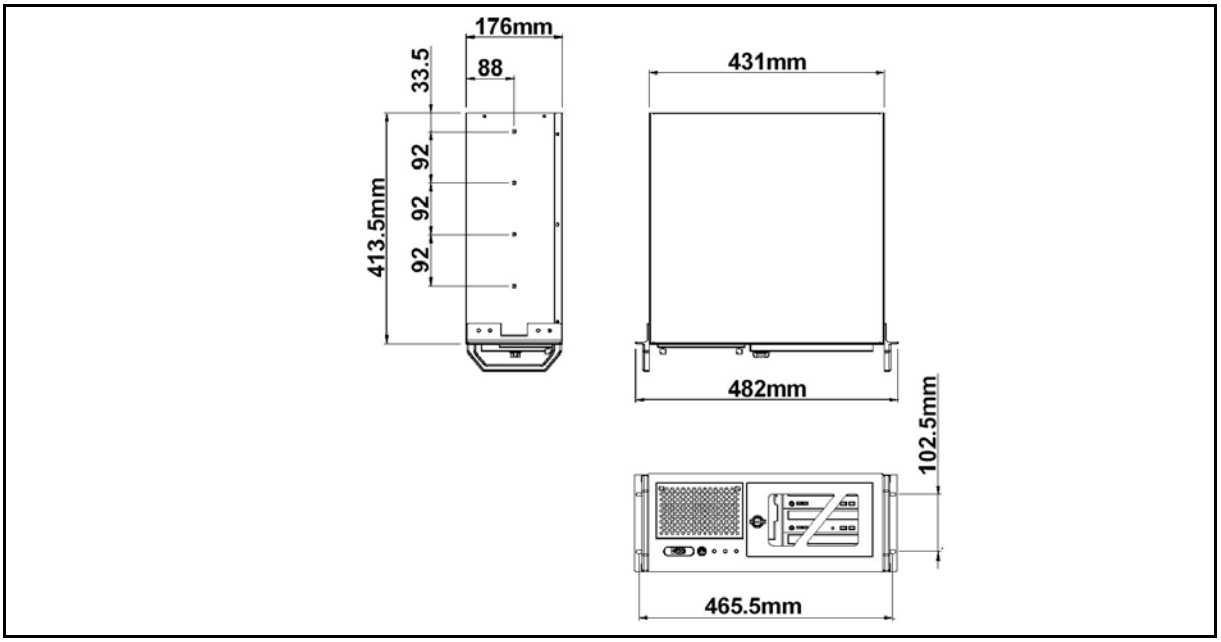


FIGURE 1: INDUSTRIAL PC DIMENSIONS

2.2.2 Front panel

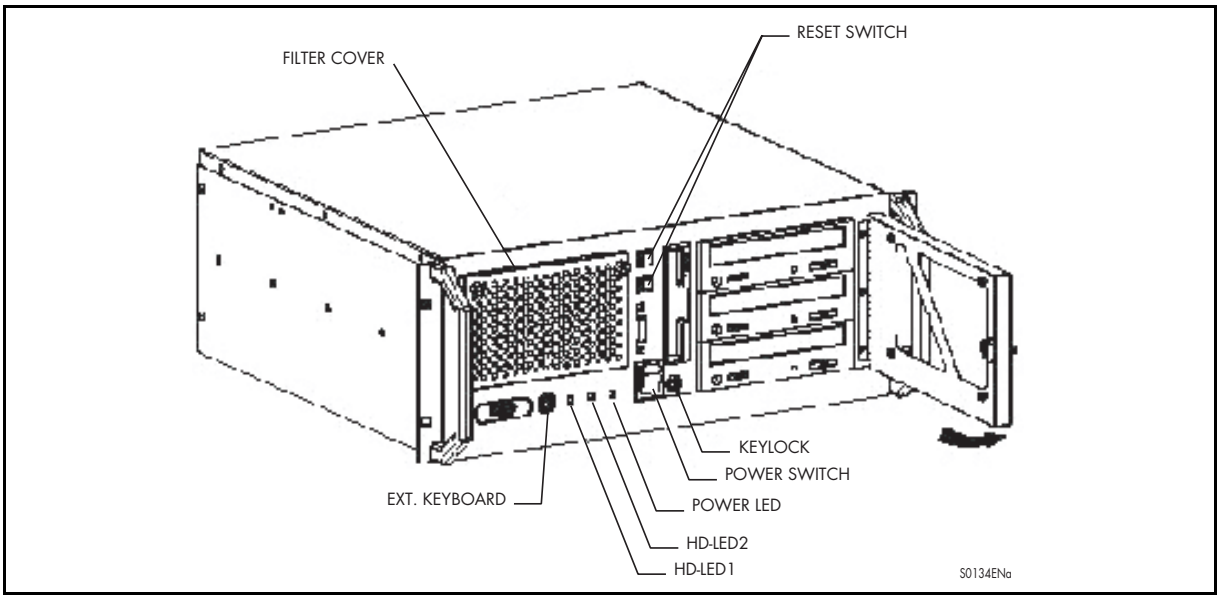


FIGURE 2: FRONT PANEL

- EXT. KEYBOARD: external keyboard is optional.
- HD LED 1and 2: indicate that the hard disk is being accessed.
- POWER LED: this led is green to indicate when the PC is powered on.
- POWER SWITCH: monostable button of the 3.3 VDC ATX power supply.. The first push powers on the PC; the second one turns it off..
- RESET SWITCH: this button is here to reset the PC.
- FILTER COVER: see the user's manual to know how to replace the filter cover.

2.2.3 Rear panel

You will need to take care of keeping some place for wiring connections.

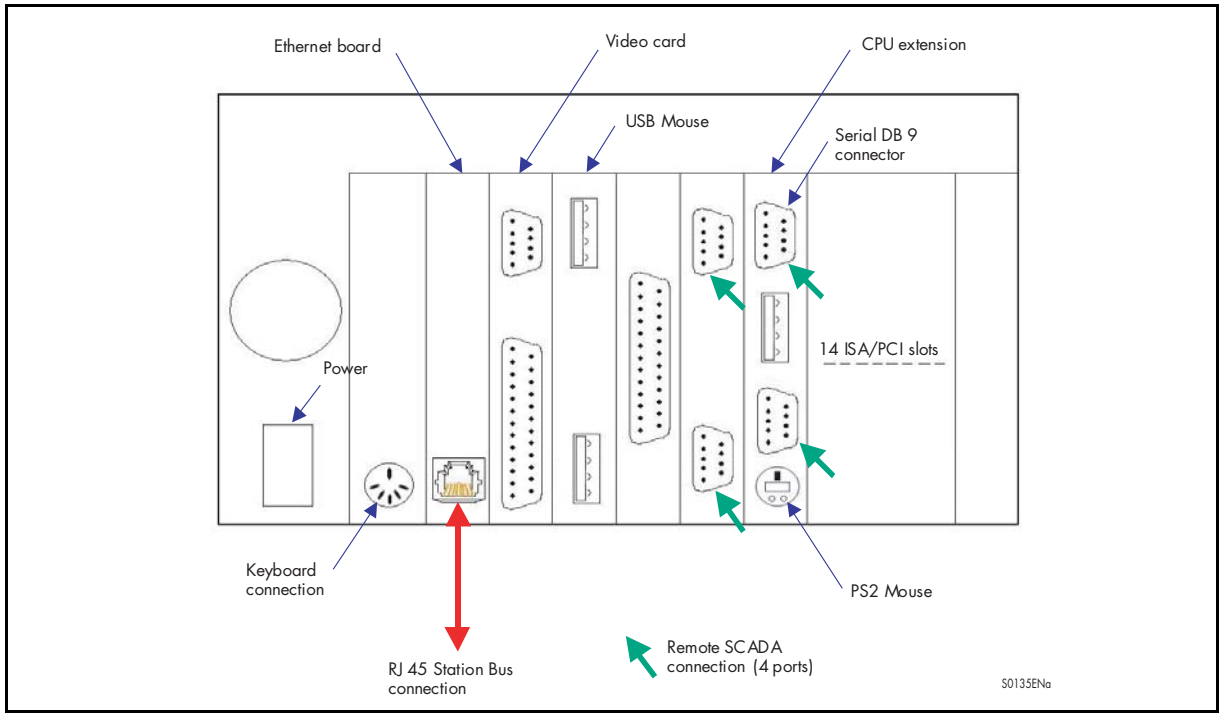


FIGURE 3: REAR PANEL

2.2.4 Power supply

The industrial PC is powered by 115V/230VAC with auto-switching.

2.3 Communication

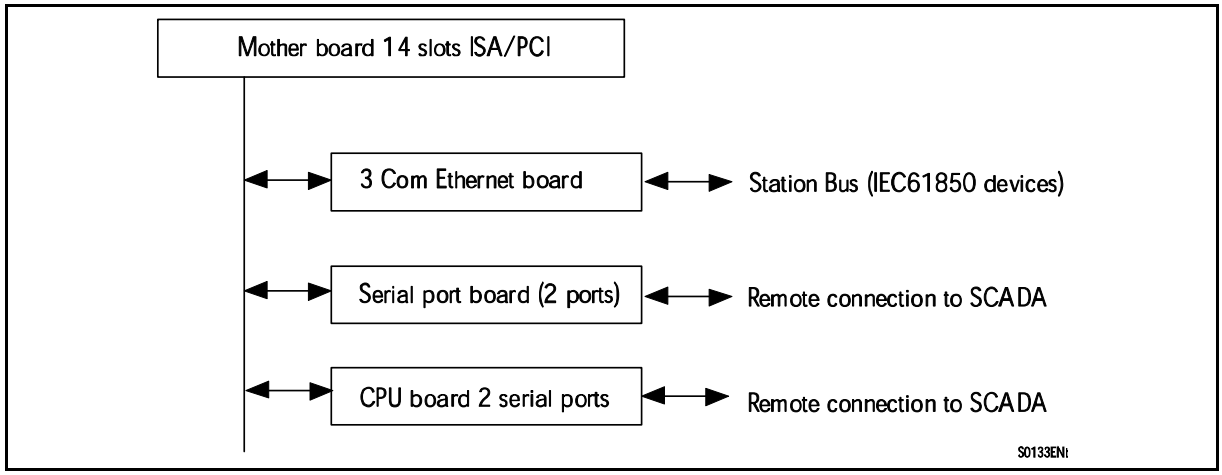

Mother board 14 slots ISA/PCI
3 Com Ethernet board
Station Bus (IEC61850 devices)
Serial port board (2 ports)
Remote connection to SCADA
CPU board 2 serial ports
Remote connection to SCADA
S0133ENa

FIGURE 4: COMMUNICATION

3. NON-ROTATING PART EMBEDDED PC MiCOM A300 DESCRIPTION

Advantech's UNO-3074 series is high-performance Pentium M/Celeron M grade, embedded automation computers with four PCI expansions.

UNO-3074 features a rugged and field-proven design offering dual power inputs and battery backup SRAM.

Different from general industrial PCs, UNO-3074 is more compact and reliable.

This is an open platform which can fulfill any demanding requirement from the industrial field, and it is an ideal solution for industrial automation and control.

UNO-3074 provides embedded operating system with a pre-configured image that has optimized onboard device drivers, and support Windows XP Embedded to fulfill the toughest requirements for complete functionality and high reliability.

Note: The product specification is detailed in the TD (Technical Data) chapter.

3.1 Main features

- Supplier: Advantech
- Reference model: UNO-3072/3074
- Onboard Pentium® M processor
- Onboard 512 KB battery-backup SRAM
- Two RS-232 & two RS-232/422/485 ports with RS-485 automatic flow control
- Four USB 2.0 ports
- Additional NIC Card: Dlink / Intel Network Card 10/100/1000 M PCI Slot
- Two/ Four PCI-bus expansion slots for versatile applications
- Industrial proven design; anti-shock up to 50 G, anti-vibration up to 2 G, Flash memory in place of hard disk
- 4-ch isolated DI, 4-ch isolated DO with timer, counter and interrupt handling
- Supports dual power inputs
- Windows® 2000/XP and Embedded Linux support
- Windows XP (SP2) Embedded ready platforms with write protection (EWF)
- Onboard system & I/O LED indicators
- Supports Boot from LAN function
- Fanless design with no internal cabling.
- Reset button
- VGA display connector
- RTX 2009 Runtime for ISaGRAF automation: Real-Time eXtension for Win32 platforms, by Interval Zero.

3.2 Front and rear view dimentions for MiCOM A300 Panel External I/O

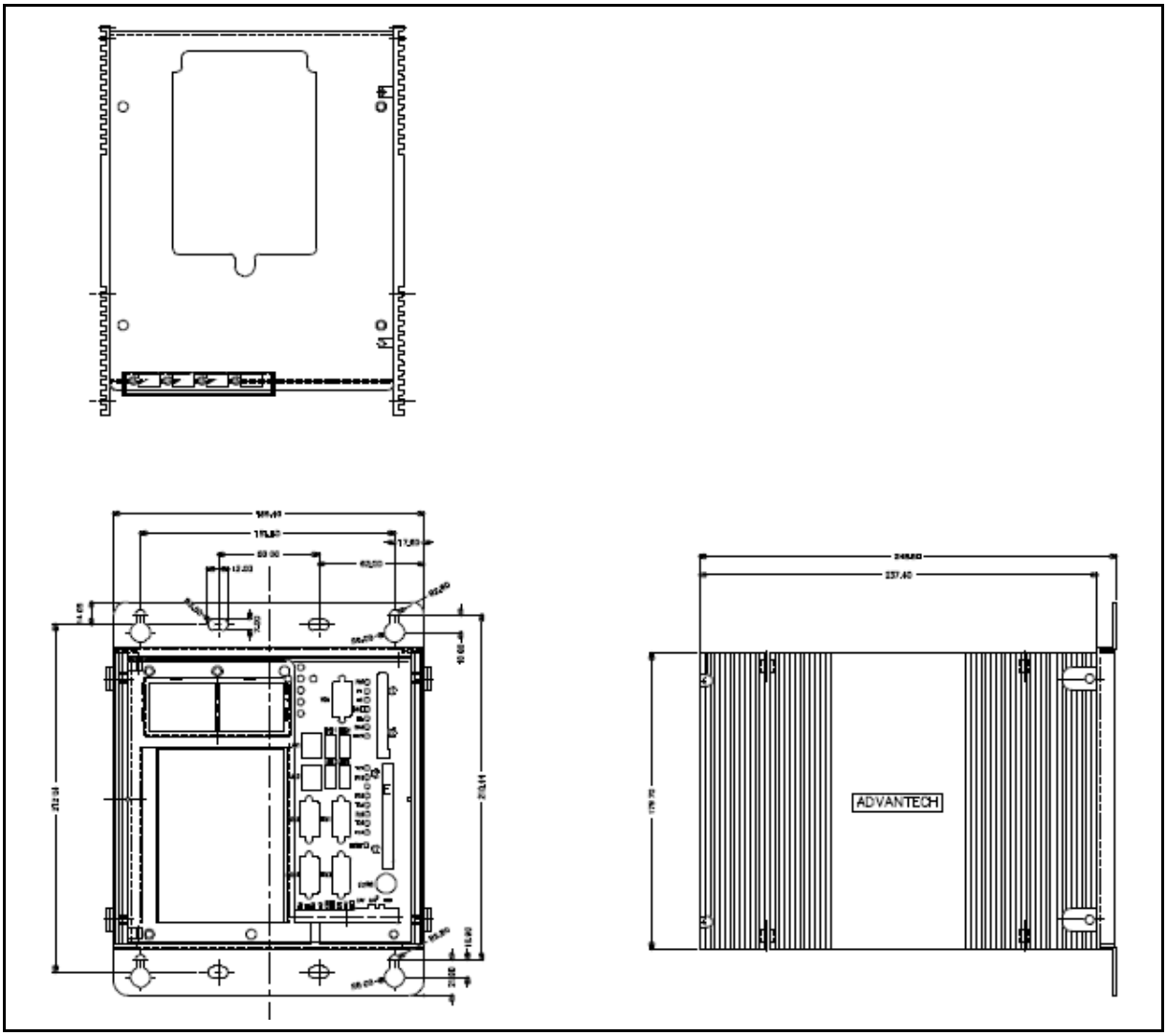


FIGURE 5: MiCOM A300 INDUSTRIAL PC DIMENSIONS

3.3 Rear Panel External I/O for MiCOM A300

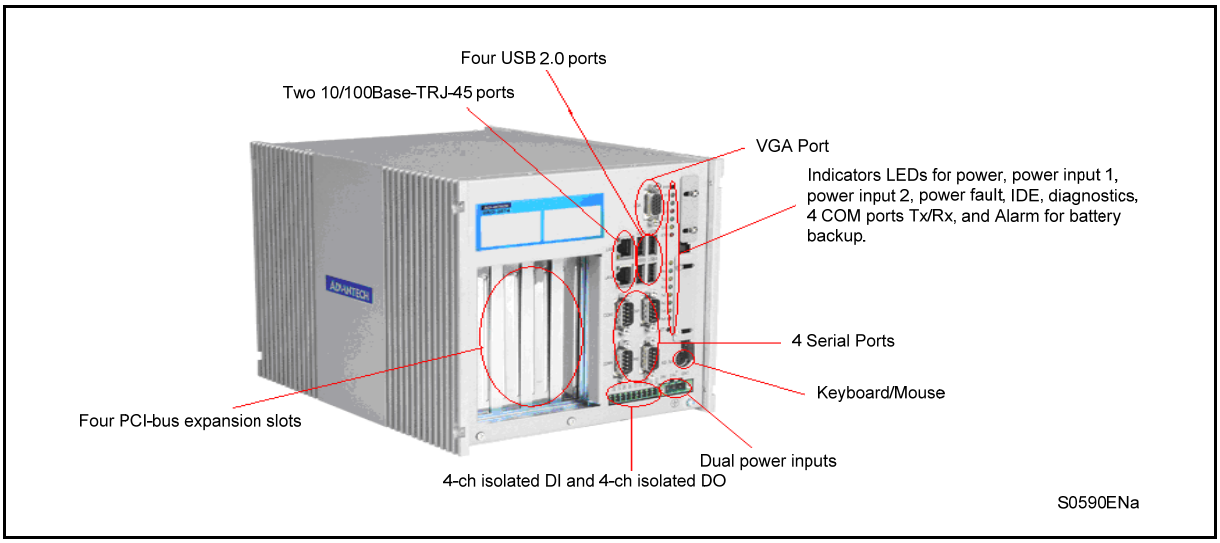

Four USB 2.0 ports
Two 10/100Base-TRJ-45 ports
VGA Port
Indicators LEDs for power, power input 1, power input 2, power fault, IDE, diagnostics, 4 COM ports Tx/Rx, and Alarm for battery backup.
4 Serial Ports
Keyboard/Mouse
Four PCI-bus expansion slots
Dual power inputs
4-ch isolated DI and 4-ch isolated DO
S0590ENa

FIGURE 6: MiCOM A300 REAR PANEL

APPLICATION

CONTENT

1.	**SCOPE OF THE DOCUMENT**	**3**
2.	**REQUIREMENTS**	**4**
3.	**PACiS GATEWAY CONFIGURATION SCOPE**	**5**
3.1	**General PACiS system configuration**	**5**
3.2	**GTW configuration in general PACiS system configuration**	**5**
3.3	**Sparing object**	**6**
4.	**DEFINING PACiS GATEWAY CONFIGURATION IN SYSTEM ARCHITECTURE**	**7**
4.1	**Adding a GTW in the system architecture**	**7**
4.2	**Setting specific parameterisation of GTW**	**8**
4.2.1	Locating GTW in a substation (mandatory)	9
4.2.2	Configuring a communication channel	9
4.3	**Networking GTW on the station-bus network**	**11**
4.3.1	Connecting GTW to others station-bus sub-systems	11
4.3.2	Defining addressing mapping of station-bus network	12
4.3.3	Addressing datapoint on station-bus network	13
4.4	**Networking SCADA on GTW SCADA network**	**13**
4.4.1	Creating a SCADA network	13
4.4.2	Defining addressing mapping of SCADA legacy network	28
4.4.3	Addressing datapoint on SCADA legacy network	55
4.5	**Setting system information for GTW components**	**56**
4.5.1	Setting general system information of GTW	57
4.5.2	Setting system information of SCADA network	58
4.6	**Gateway legacy networks**	**60**
4.6.1	Creating a Gateway legacy networks	60
4.6.2	Setting specific attributes of a MODBUS IED network	60
4.7	**Defining a PLC**	**63**
5.	**DEFINING PACiS GATEWAY CONFIGURATION IN ELECTRICAL ARCHITECTURE**	**64**
5.1	**Defining Substation and Bay Local/Remote dependencies**	**64**
5.1.1	Introduction	64
5.1.2	Setting ‘Local/remote dependencies’ attributes of control datapoint	65
5.2	**Setting SBMC dependency attribute of control datapoint**	**66**
5.2.1	Introduction	66
5.2.2	Setting ‘SBMC dependency’ attribute of control point	66

5.3 Defining Taking Control for substation and SCADA links 67

5.4 Defining an ISaGRAF RT automation 69

5.4.1 Creating an ISaGRAF RT automation (header definition) 70

5.4.2 Adding specific datapoints to RT automation (interface definition) 71

5.4.3 Creating ISaGRAF client link (interface definition) 72

5.4.4 Creating ISaGRAF server link (interface definition) 73

5.4.5 Using ISaGRAF editor (body definition) 74

6. DEFINING IEC61850/IEC61850 PACiS GATEWAY CONFIGURATION 76

6.1 Configuring the GTW in the lower network 77

6.2 Configuring the GTW in the upper network 79

7. DEFINING PACiS GATEWAY INITIALIZATION TIMER 83

1. SCOPE OF THE DOCUMENT

The present document is a PACiS Gateway (GTW) chapter of the documentation binder. This document is intended to present you how to configure the GTW. It is the chapter Application (AP) of this Product.

2. REQUIREMENTS

First, if it is not already done, you will need to install the PACiS SCE (System Configuration Editor), see the chapter IN (Installation) of this product.

This document presents you the objects and the attributes of a referenced database made with the PACiS SCE. For understanding this document you first need to be familiar with PACiS SCE.

Moreover, this document reduces PACiS Gateway (GTW) configuration to GTW functionality, that are datapoint real-time values and controls transmitted for SCADA. These datapoints are globally produced and managed by others PACiS sub-systems mainly MiCOM C264 computers. So, the configurations of datapoint and by extension of the substation electrical topology where datapoints are attached are pre-requirements to GTW configuration. They are not described is the present document, but in the MiCOM C264/C264C application chapter (C264/EN AP). Nevertheless, some items of datapoint and electrical topology configuration can be repeated and reformalised in the present document as far as GTW functionality are concerned by.

To add a PACiS GTW into an existing system you need to have the mapping of the system (IP address, Network names of equipment…).

To generate a template, for an existing GTW, see the chapter of the PACiS SCE product.

3. PACiS GATEWAY CONFIGURATION SCOPE

3.1 General PACiS system configuration

To define a complete PACiS system, three aspects should be taken into account.

The first one is the system topology. It consists of device composition that manages the customer's electrical process. Generally, this part of furniture is relevant to Schneider Electric and corresponds to Schneider Electric system process definition to respond customer's needs.

The second one is the electrical topology. It consists of the customer's electrical process definition in term of typed electrical devices (transformer, disconnector, circuit-breaker…) that are connected each other through busbars or lines. Generally, this part of furniture is relevant to the customer.

The third one is the graphical topology. It consists of the mimic and their graphical animation descriptions that appear at substation control points (operator interface) and bay control points (MiCOM C264 computer local HMI).

When creating a new configuration using SCE, these 3 topologies are automatically instantiated via root objects:

- A 'Site' object for the electrical topology, containing one 'Substation' object
- A 'Scs' object for the system topology, containing one 'Station network' object (Scs is an abbreviation of Substation Control System)
- A 'Graphic' object for the graphical topology.

FIGURE 1: GENERAL ARCHITECTURE OF A PACiS CONFIGURATION IN SCE

3.2 GTW configuration in general PACiS system configuration

In general PACiS system configuration, GTW is concerned by the two topologies:

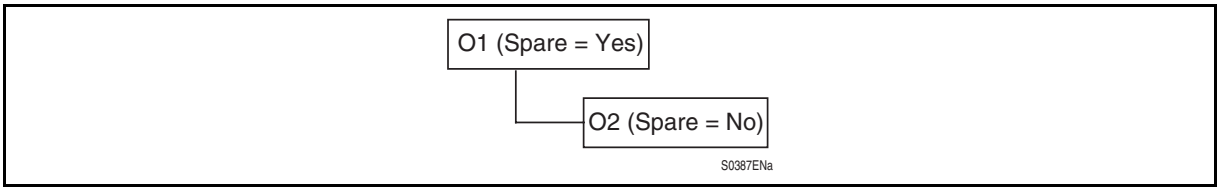
- System topology (Scs): GTW is a direct sub-component of the Ethernet network used for communication at station bus level.
- Electrical topology (Site): GTW behaviour is dependent of substation and bay mode facilities.

3.3 Sparing object

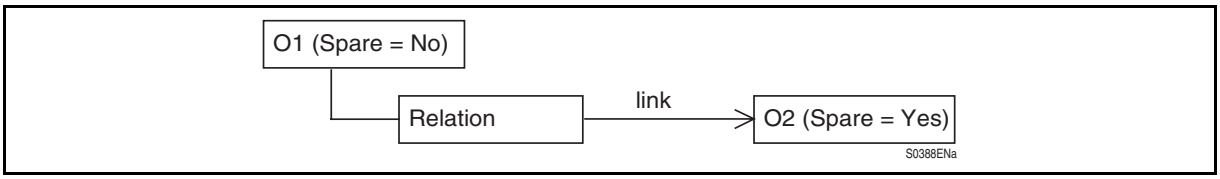
At SCE level, a spare object is an object having its spare attribute set to true. The configuration of this object and of its spare attribute is the same as for any other object and attribute. Any object can be spare and particularly those concerning MiCOM C264 computer configuration.

Spare objects are not provided to the generator tools, respecting the following rules:

- An object O2, not spare, linked directly or not to a spare composite parent object O1, is considered as spare.



- A relation defined on an object O1, not spare, and linked to a spare object O2, is considered as a relation without link.



4. DEFINING PACiS GATEWAY CONFIGURATION IN SYSTEM ARCHITECTURE

4.1 Adding a GTW in the system architecture

Addition of a GTW definition is done under SCE via the “Objects entry” area at Ethernet network level by clicking on mouse’s right button as the following:

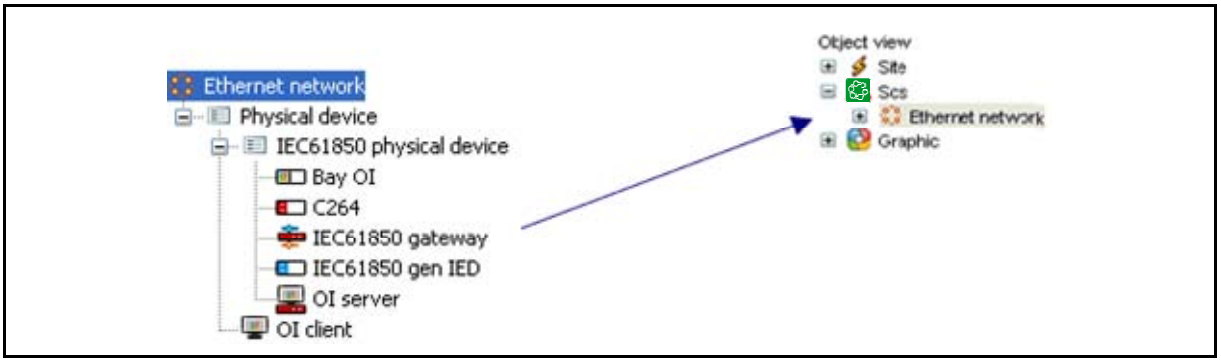


FIGURE 2: ADDING A GTW

Default components of a GTW

When you add a GTW from the “Objects Entry” view, you will obtain the following sub-tree of the GTW definition with the default components as follows:

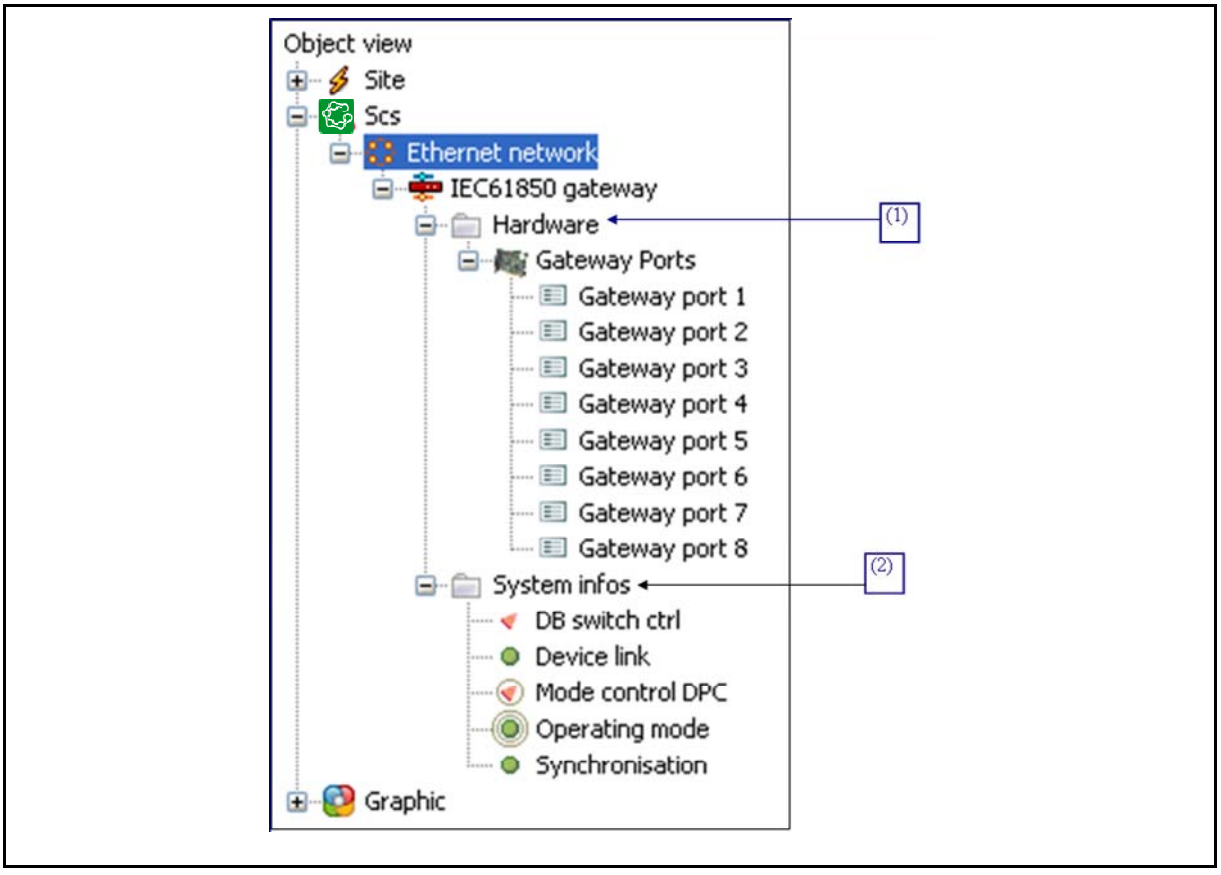


FIGURE 3: DEFAULT COMPONENTS OF THE GTW

1. Binder ‘Hardware’, that groups all available communication channels of the GTW.
2. Binder ‘System infos’, that groups all general system datapoints of the GTW (see section 4.5 Setting system information for GTW components)

4.2 Setting specific parameterisation of GTW

When adding a GTW on Ethernet network, some of its attributes must be set. Hereafter are listed these attributes.

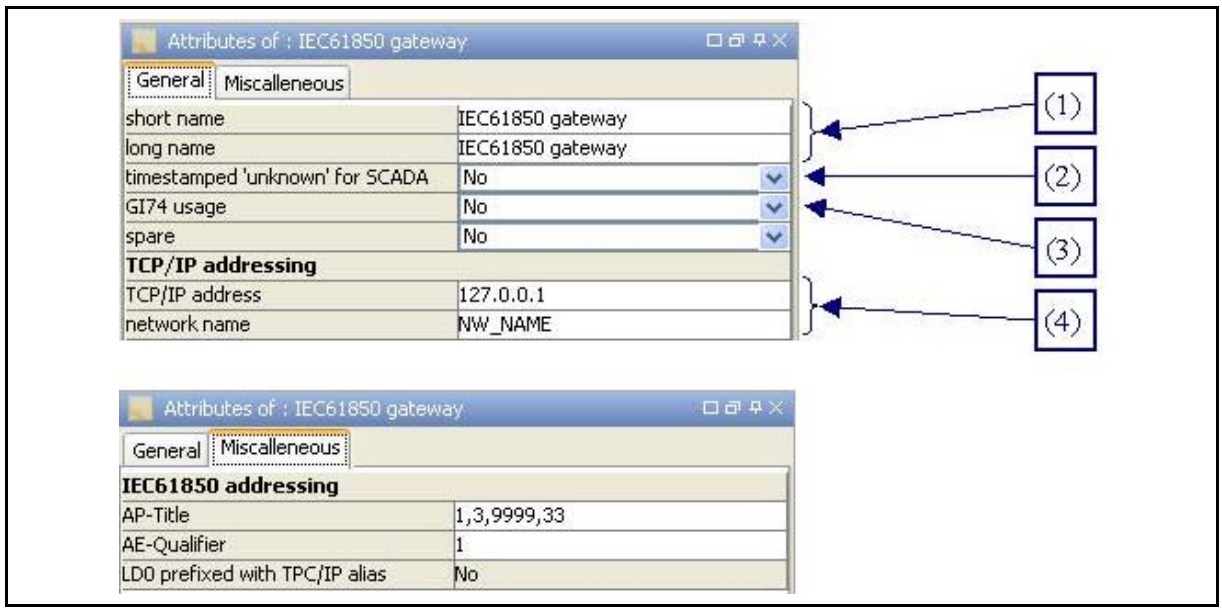


FIGURE 4: SETTING GENERAL ATTRIBUTES OF A GTW

1. **short name** and **long name**: used for logging, alarms, …

2. **GTW timestamp at connection** (No / Yes): this attribute defines the way datapoints are time-stamped when the GTW connects to a Station Bus server (after a loss of communication with this server). If this attribute is set to **No** the datapoints coming from this server are time-stamped with the acquisition date (which can be antecedent to the loss of communication). If this attribute is set to **Yes** the datapoints are time-stamped with the date/time of the connection (in this case the acquisition time-stamp provided by the station bus server is lost).

3. **GI74 usage** (No / Yes): this attribute indicates if GI 74 protocol is used at GTW level. Use the default value. The value 'Yes' must not be used. It is still proposed for maintenance reason.

4. **TCP/IP address** and **network name**

Configuration rules and checks

- The "TCP/IP address" value of a device, must be unique among all the devices per Ethernet Network (except for OI server and OI client).It is the TCP/IP address on the SBUS.

- The "network name" value of a device, must be unique among all the devices per Ethernet Network (except for OI server and OI client).It is the PC's name limited to 15 characters.

4.2.1 Locating GTW in a substation (mandatory)

Each system device has to be located in a specific substation. This is done by entering the mandatory relation (1) “is located in:“ for each system device, especially GTWs.

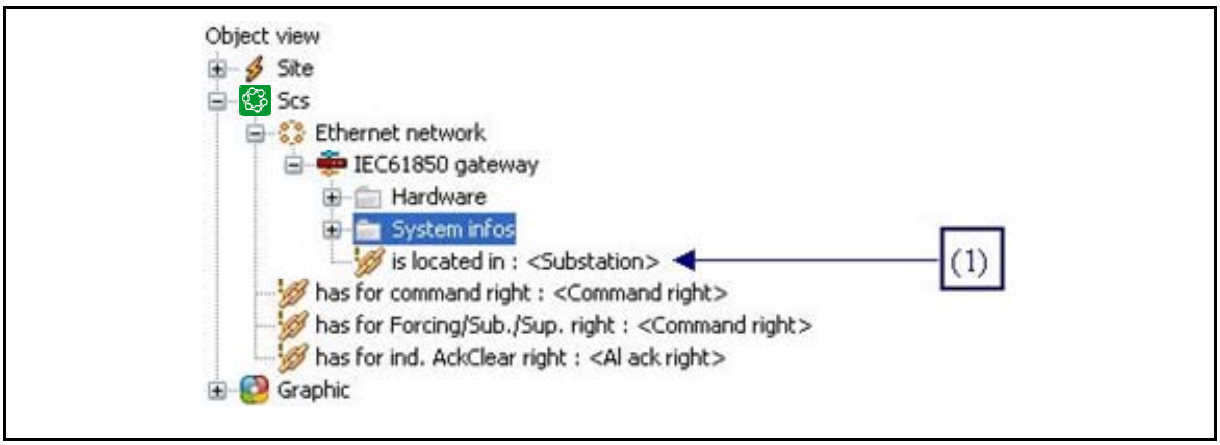


FIGURE 5: LOCATING GTW IN A SUBSTATION

4.2.2 Configuring a communication channel

Up to eight serial ports for communication with SCADA are available on a GTW. These ports are automatically created when adding a GTW (1). Depending on PC architecture running the GTW software, less than eight ports can be useable. Generally, two serial ports are provided with a PC. By using extra boards, the number of serial ports can be increased.

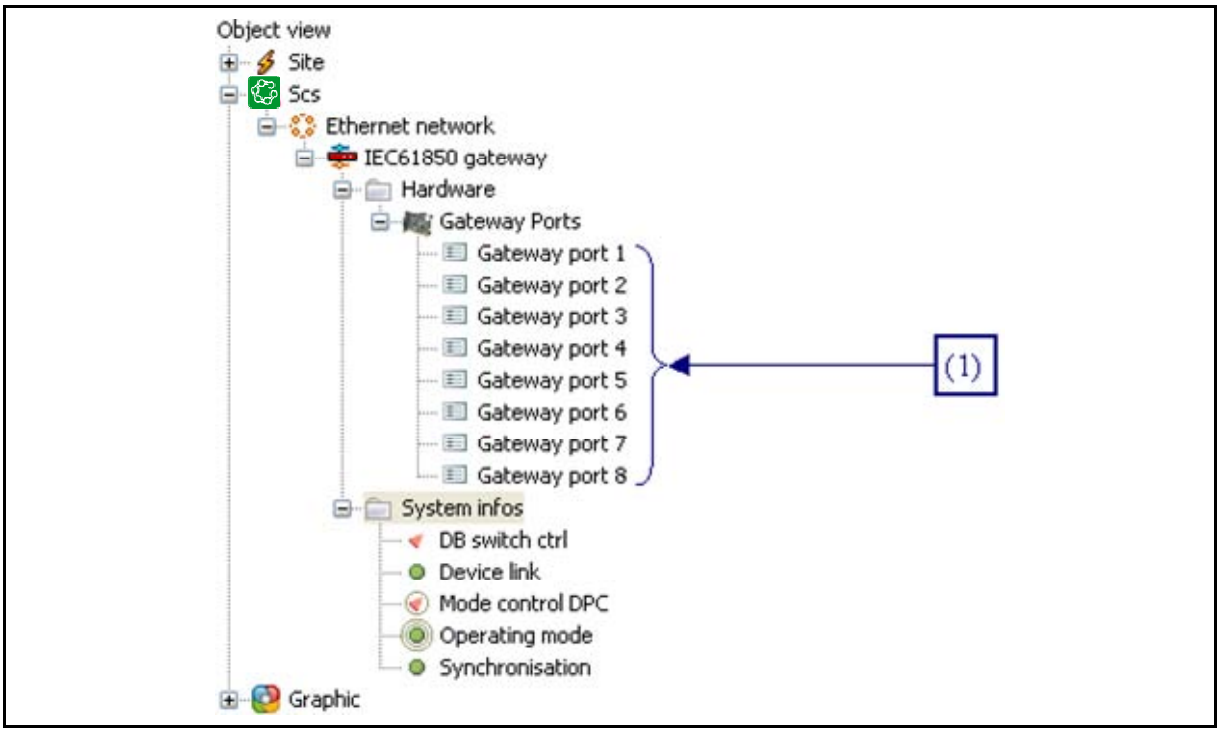


FIGURE 6: GTW COMMUNICATION CHANNEL

Once used by a communication link, the physical port has to be set relatively to the communication link characteristics:

1. **protocol type** (Usual protocol / GI 74 protocol / V35 ACKSYS-MCX): use the default value. The value ‘GI 74’ must not be used. It is still proposed for maintenance reason. The V35 ACKSYS-MCX value must be selected only if a board Acksys MCXPCI/570-2 is installed in the GTW.

2. **baud rate (bits/s)**: of the serial link (100 / 200 / 300 / 600 / 1200 / 4800 / 9600 / 19200 / 38400).

3. **plug com.** number (range [1,16],step 1): attached to the port.

4. transmitted **clock** (given by RXClockIn ext signal / given by TXClockIn ext signal / given by bauds generator): this attribute exists only if the attribute **protocol type** is set to **V35 ACKSYS-MCX)**: this attribute defines the origin of the clock for the transmitted signal when the board is used in synchronised asynchronous mode. When this attribute is set to **given by bauds generator** the baud rate is actually forced to 64000 bits/s.

5. **received clock** (given by RXClockIn ext signal / given by TXClockIn ext signal / given by bauds generator) this attribute exists only if the attribute **protocol type** is set to **V35 ACKSYS-MCX)**: this attribute defines the origin of the clock for the received signal when the board is used in synchronised asynchronous mode. When this attribute is set to **given by bauds generator** the baud rate is actually forced to 64000 bits/s.

6. **clock signal** (high permanent / transmit clock / bauds generator clock): this attribute exists only if the attribute **protocol type** is set to **V35 ACKSYS-MCX)**

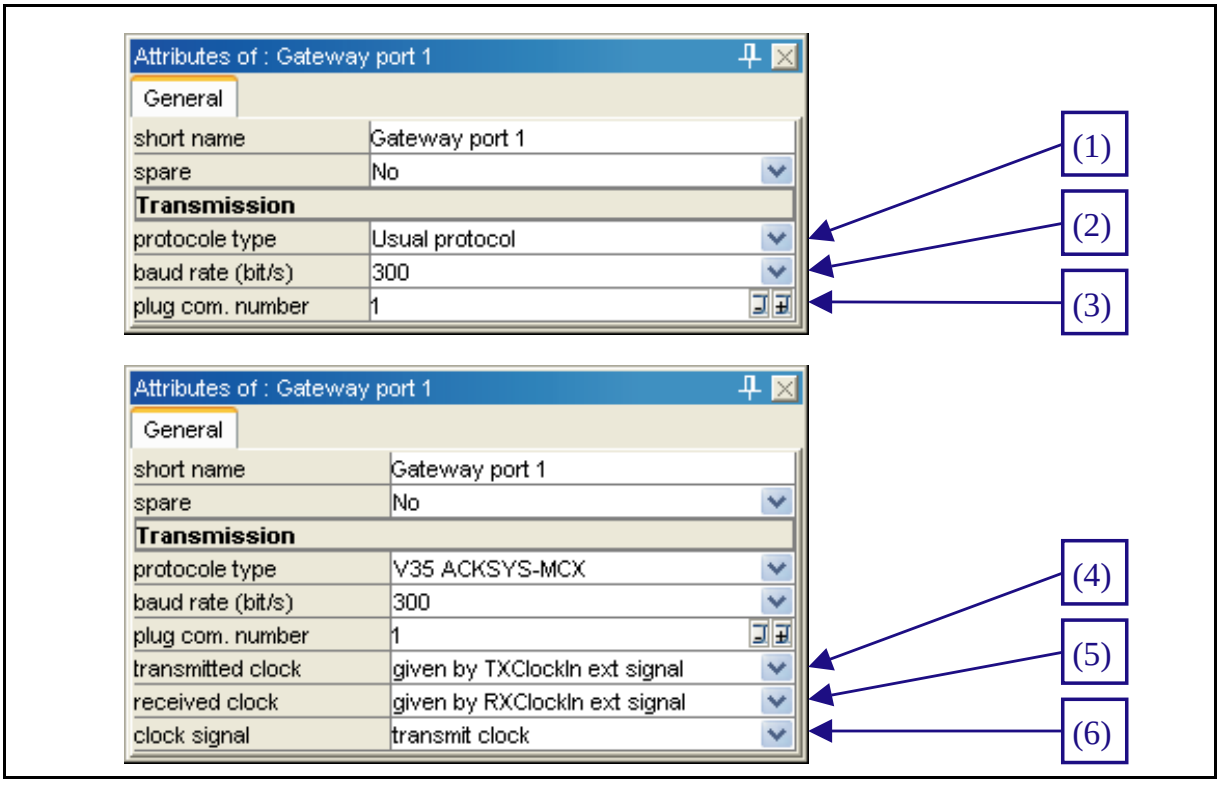


FIGURE 7: CONFIGURING A COMMUNICATION CHANNEL (E.G. FOR PORT 1)

4.3 Networking GTW on the station-bus network

GTW connection to the station-bus is implicitly done by adding the GTW hierarchically to the Ethernet network (see section 4.1 Adding a GTW in the system architecture) and by setting its IP characteristics (see 4.2 Setting specific parameterisation).

4.3.1 Connecting GTW to others station-bus sub-systems

To transmit information between PACiS sub-systems, IEC61850 protocol is used.

The data modelling of IEC 61850 protocol is based on a client-server architecture. Each IEC 61850 communicant PACiS sub-system (PACiS OI server, MiCOM C264 computer, and PACiS GTW) owns an IEC 61850 mapping of data which it is server of. A PACiS sub-system is server of a datapoint if it manages it, that is to say it produces its real-time value (in case of input datapoint such as status, measurement, counter) or executes its real-time controls (in case of output datapoint such as binary controls and setpoints).

To connect a GTW (A) to a specific IEC 61850 communicant sub-system (B) on the station-bus, an extra relation 'has for IEC 61850 server' must be created for (A) and point to (B). That means GTW (A) is client of sub-system (B) and can access to data managed by the sub-system (B), i.e. read relevant real-time values from (B) and send real-time controls to (B).

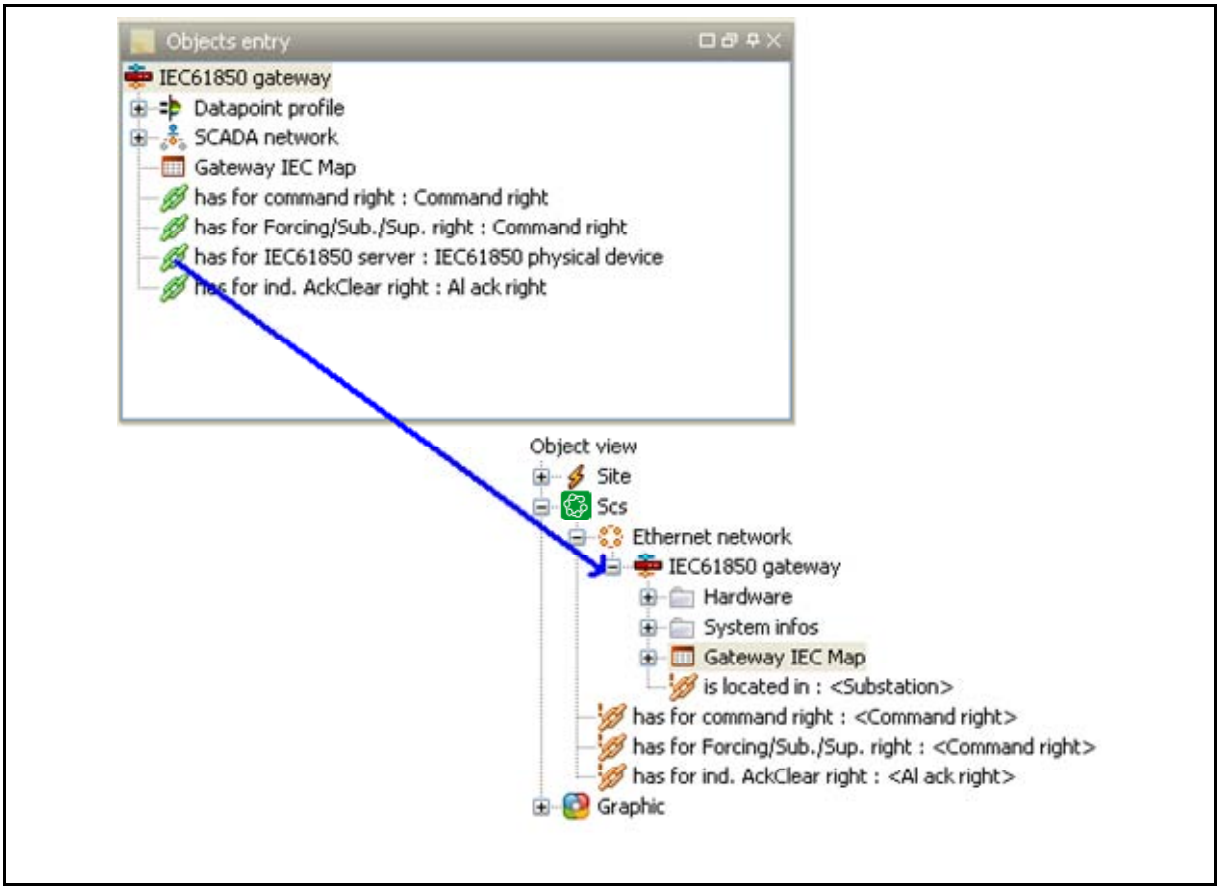


FIGURE 8: CONNECTING GTW TO OTHERS STATION-BUS SUB-SYSTEMS

When adding the 'has for IEC61850 server' relation to GTW (A), the specific attribute of the relation, modelling/goose usage (1), is not significant: use its default value (Data model only).

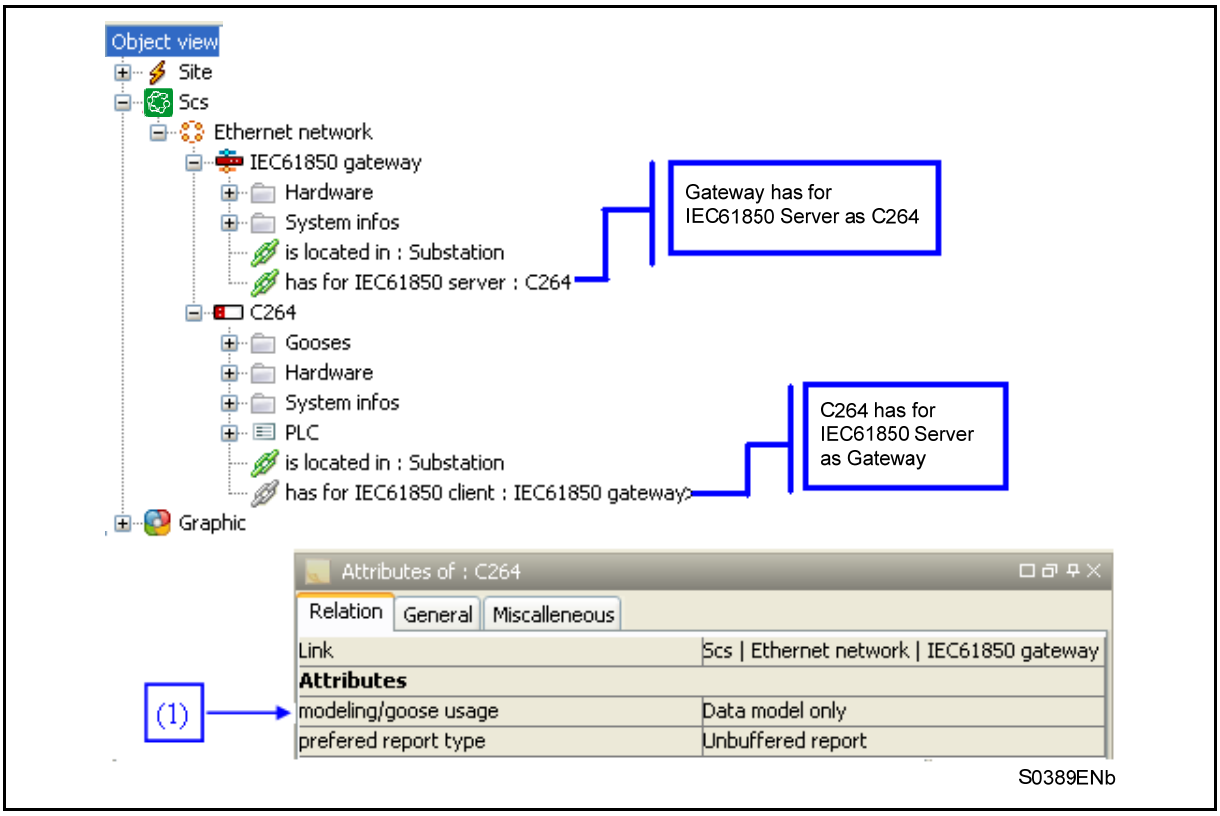


FIGURE 9: GTW (A) AS IEC61850 CLIENT OF MiCOM C264 COMPUTER (B)

4.3.2 Defining addressing mapping of station-bus network

An IEC 61850 mapping is an aggregation of logical devices, composed of bricks. Generally, a brick corresponds to an electrical device or function. It provides its real-time data (status, measurements, and controls …) and some configuration aspects. To do that, a brick groups data by categories (Status, measurement, Control, Configuration), called functional components.

A functional component groups data objects. A data object must be seen as a real-time equivalent of a PACiS datapoint. So, when a PACiS sub-system (IEC 61850 client) needs the real-time value of a datapoint manages by another sub-system (IEC 61850 server), this last one transmits the information via a data object of its own IEC 61850 mapping. At SCE data modelling level, IEC61850 clients must precise which IEC61850 servers it retrieves information from (see section 4.3.1 Connecting GTW to others station-bus sub-systems).

Generally, an IEC 61850 data object has a stereotype, called common class. The structures of these ones are known by all PACiS IEC 61850 communicant sub-systems. For PACiS sub-systems, the number and structure of common classes are fixed. They are the terminal description of IEC61850 PACiS data modelling.

In IEC 61850 Mapping of PACiS sub-system, there is a native logical device LD0 with fixed and hard-coded bricks (DBID, DI (LPHD), GLOBE (LLN0), and DIAG). When creating a PACiS GTW at SCE level, an IEC 61650 mapping with LD0 and its default bricks is also created. LD0 is a system logical device that groups all system diagnostics and controls relevant to the GTW. Datapoints addressed in the brick of LD0 are only relevant to system topology.

Extra logical devices can not be created in the IEC 61850 mapping of a GTW. Their usages are reserved for MICOM C264 computer configuration.

Overview of GTW IEC 61850 mapping's LD0

The LD0 of PACiS GTW is fixed and composed of the following bricks:

- DBID (DataBase IDentity) used for MiCOM C264 computer databases identification and management,
- DI (Device IDentity)/LPHD used for MiCOM C264 computer identification,
- GLOBE/LLN0 used for MiCOM C264 computer mode management
- TGDIAG brick, grouping statuses relevant to SCADA links managed by the GTW

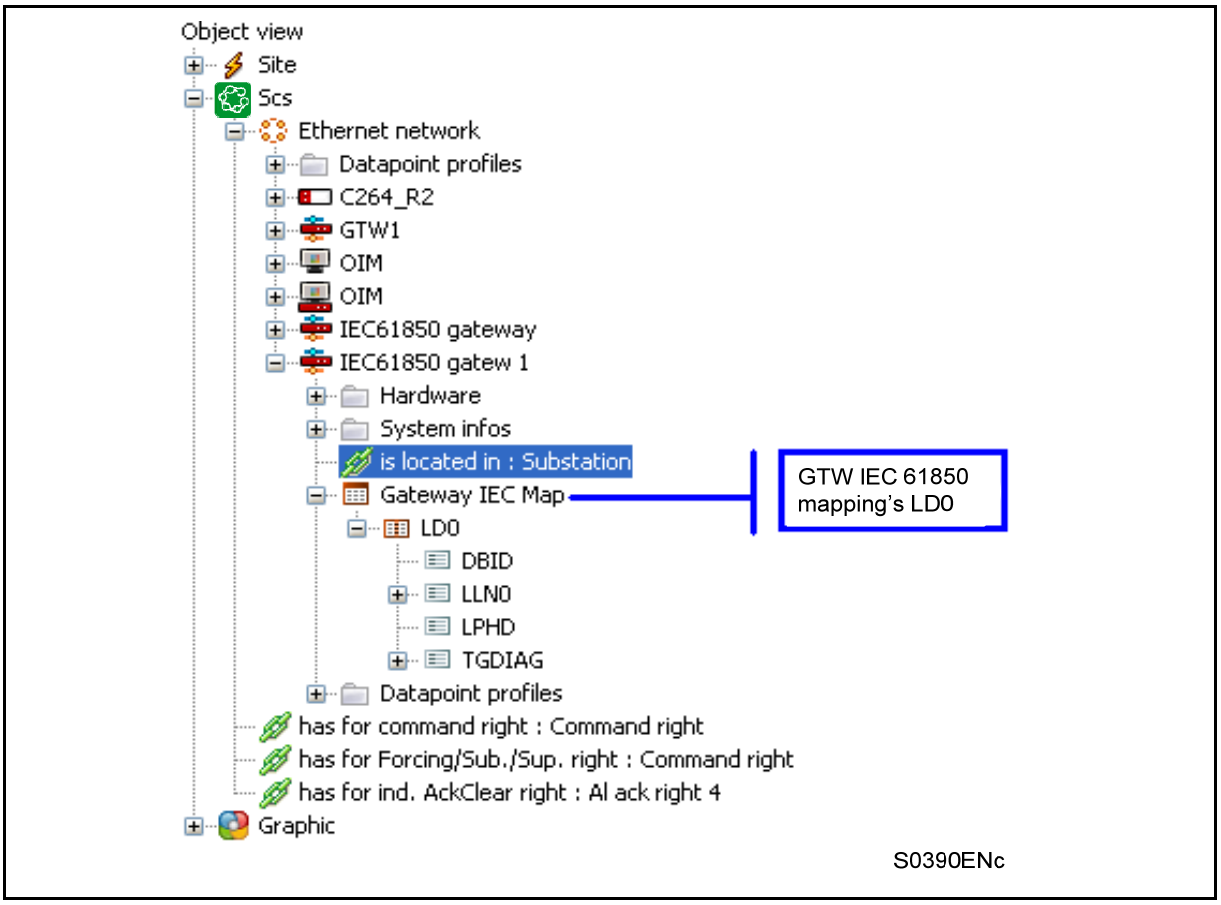


FIGURE 10: STANDARD LD0 EXTENSION FOR GTW (SCE)

4.3.3 Addressing datapoint on station-bus network

For details refer to the C264/C264C application chapter (C264/EN AP).

4.4 Networking SCADA on GTW SCADA network

4.4.1 Creating a SCADA network

An electrical substation can be supervised and controlled from many points inside the substation via PACiS operator interfaces (Substation Control Point or SCP) and/or PACiS MiCOM C264 computer bay panels (Bay Control Point or BCP), and outside the substation. Generally, the distant control of the substation (Remote Control Point or RCP) is done via specific networks called SCADA legacy networks.

Several SCADA legacy networks can be connected to a PACiS system, via PACiS MiCOM C264 computer or PACiS GTW sub-systems. SCADA legacy networks are managed as master by distant SCADA and can be redundant for safety reason. A PACiS GTW can manage up to four SCADA networks.

At SCE data modelling level, only SCADA legacy networks and their protocol are modelled and connected to GTW sub-systems. Each SCADA network has to be linked to a main communication port and eventually an auxiliary communication port in case of redundancy.

4.4.1.1 Adding a SCADA network

To create a SCADA network on a GTW:

- Add a SCADA network ("Usual protocol" given as an example in the following figure) from object entry available at GTW level (1),
- Update the SCADA network attributes relevant to its protocol characteristics (see following sections),
- Update its 'has for main communication port' relation and the communication port characteristics (see section 4.2.2 Configuring a communication channel). This relation is not significant for T104 protocol using an Ethernet protocol.
- To create a redundant SCADA link, add the relation 'has for aux. comm. port' (2) extra relation on GTW SCADA network and type the related serial port. The T104 protocol does not support the redundant SCADA link.

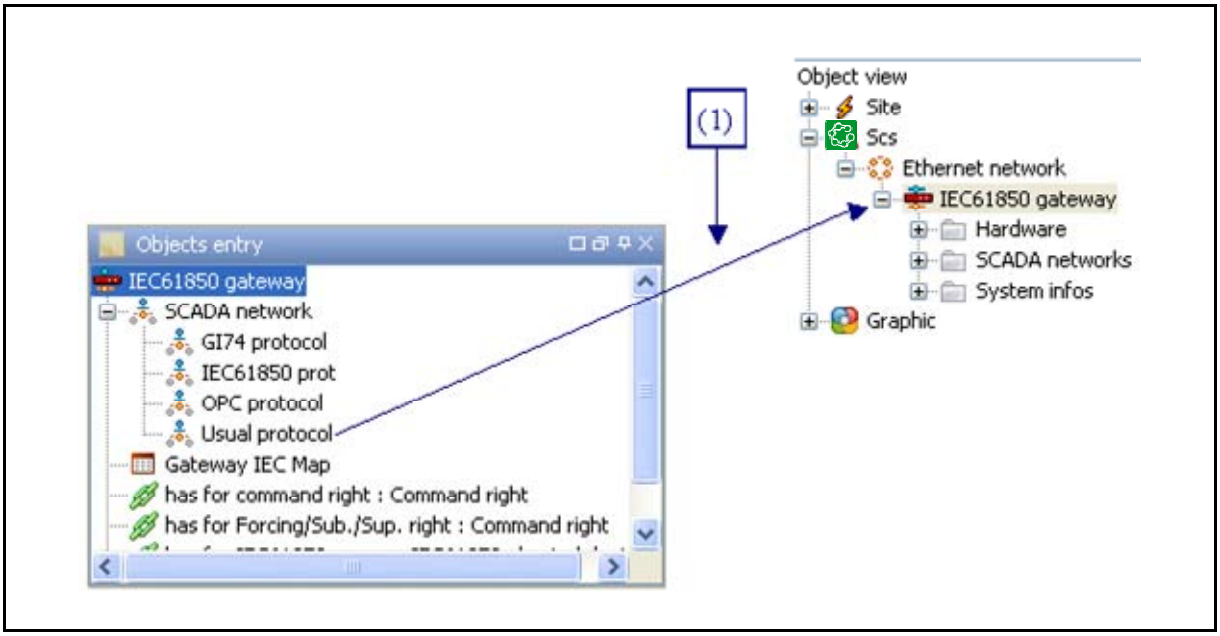


FIGURE 11: ADDING A SCADA NETWORK

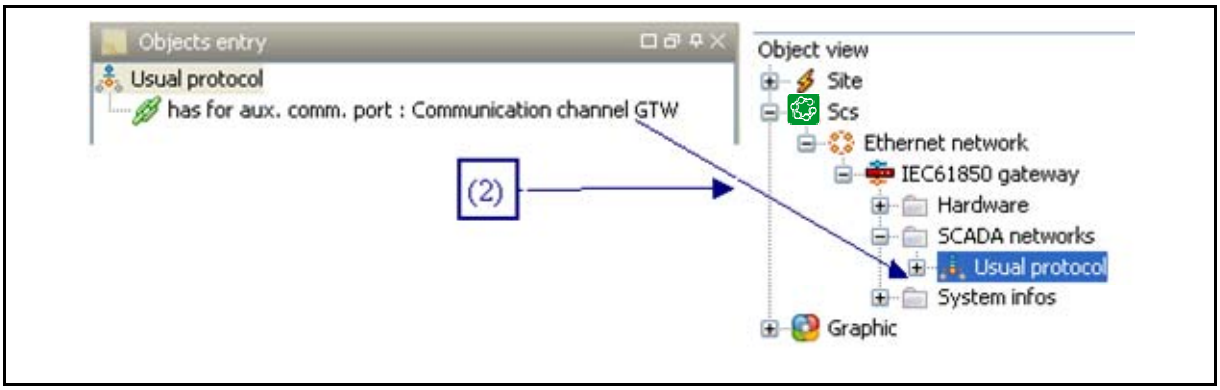


FIGURE 12: CREATING A REDUNDANT SCADA LINK

4.4.1.2 Setting general attributes of a SCADA network

Whatever the kind of SCADA network, its **short name** and **long name** attributes (1) must be updated for correct logging and alarm discrimination concerning status datapoints managed by the GTW for each connected SCADA network as shown in figure 13.

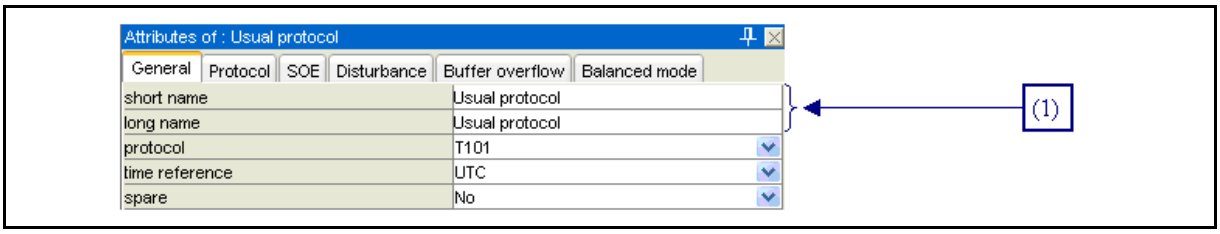


FIGURE 13: SETTING GENERAL ATTRIBUTES OF A SCADA NETWORK

4.4.1.3 Setting specific attributes of a T101 SCADA network

When adding a SCADA network, the supported protocol must be updated (1). Here, set it to 'T101'. For this protocol an additional attribute '**time reference**' (2) is displayed and has to be set. Available values for this attribute are UTC or local. This attributes defines which time reference is used to stamp events transmitted to SCADA as shown in figure 14 and figure 15.

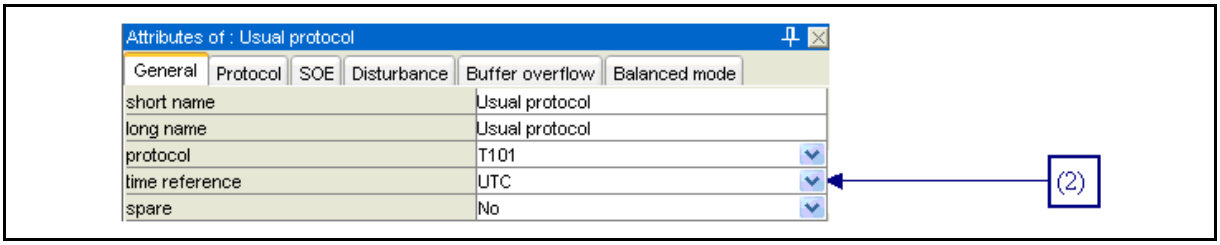


FIGURE 14: SETTING PROTOCOL TYPE OF A SCADA NETWORK

When setting a T101 SCADA network, some specific attributes available for the protocol must be updated (Protocol and SOE tab-panes):

1. **link** address **length** (1 byte / 2 bytes)
2. **link address** (range [1, 65534], step 1)
3. **redundant link address** (range [1, 65534], step 1): this attribute is significant if a line redundancy is configured for the protocol (refer to section 4.4.1.1 Adding a SCADA network).
4. **ASDU** common **address length** (range [1, 65534], step 1)
5. **ASDU** common **address** (range [1, 65534], step 1)
6. **information object length** (Address on 8 bits (1 byte) / Address on 16 bits (2 bytes) / Address on 8 bits.8 bits / Address on 8 bits.16 bits / Address on 16 bits.8 bits / Address on 8 bits.8 bits.8 Bits / Address on 24 bits (3 bytes))
7. **frame max length** (range [1, 255], step 1)
8. **cause of transmission length** (Address on 8 bits / Address on 16 bits)
9. **MV periodic cycle** (range [0 s, 65534 s], step 1 s)
10. **binary time size** (CP24Time2A (3 bytes) / CP56Time2A (7 bytes))
11. **background scan cycle** (range [0 s, 65535 s], step 1 s)
12. **quality** value **for toggling xPS** (BL only (blocked) / IV only (invalid): this attribute defines the value of the Quality Descriptor field when the event to transmit is an xPS in the TOGGLING state.

13. **SOE file support** (No / Yes (Standard) / Yes (Microsol)): set to ‘Yes’ if SOE file management is supported by the SCADA

14. **SOE file base address**: this attribute is significant only if **SOE file support** is not set to **No**.

15. **SOE file nb** max **of events** (range [10, 4200], step 1): this attribute is significant only if **SOE file support** is not set to **No**.

16. **nb max of SOE files** (range [1,99], step 1): this attribute is significant only if **SOE file support** is not set to **No**.

17. **Buffer overflow support** (No / Yes): this attributes defines if the buffer overflow is managed. If set to Yes the following attribute is significant and has to be updated.

18. **Buffer overflow address** (No / Yes): this attributes defines the address of the buffer overflow datapoint sent to SCADA.

19. **Quality value for 'Jammed' state** (valid \ IV invalid): this attribute defines the value of the Quality Descriptor field when the event to transmit in the 'Jammed' state.

20. **Quality value for 'Unknown' state** (Not topical only \ Not topical and IV invalid): this attribute defines the value of the Quality Descriptor field when the event to transmit in the 'Unknown' state.

21. **Balanced mode** (No/Yes): this attribute defines balanced mode if set to yes.

22. **Balanced mode retry number**: number of unsuccessful polls before the slave is declared disconnected.

23. **Balanced mode link timeout**: delay.

24. **SQ value for TS**: SQ flag value for TS data points (refer to the CT Chapter).

25. **SQ value for TM**: SQ flag value for TM data points.

26. **SQ value for Counters**: SQ flag value for counter data points.

27. **Gap address to split**: Max_Gaps_DP value, used to adjust the passband (refer to the CT Chapter).

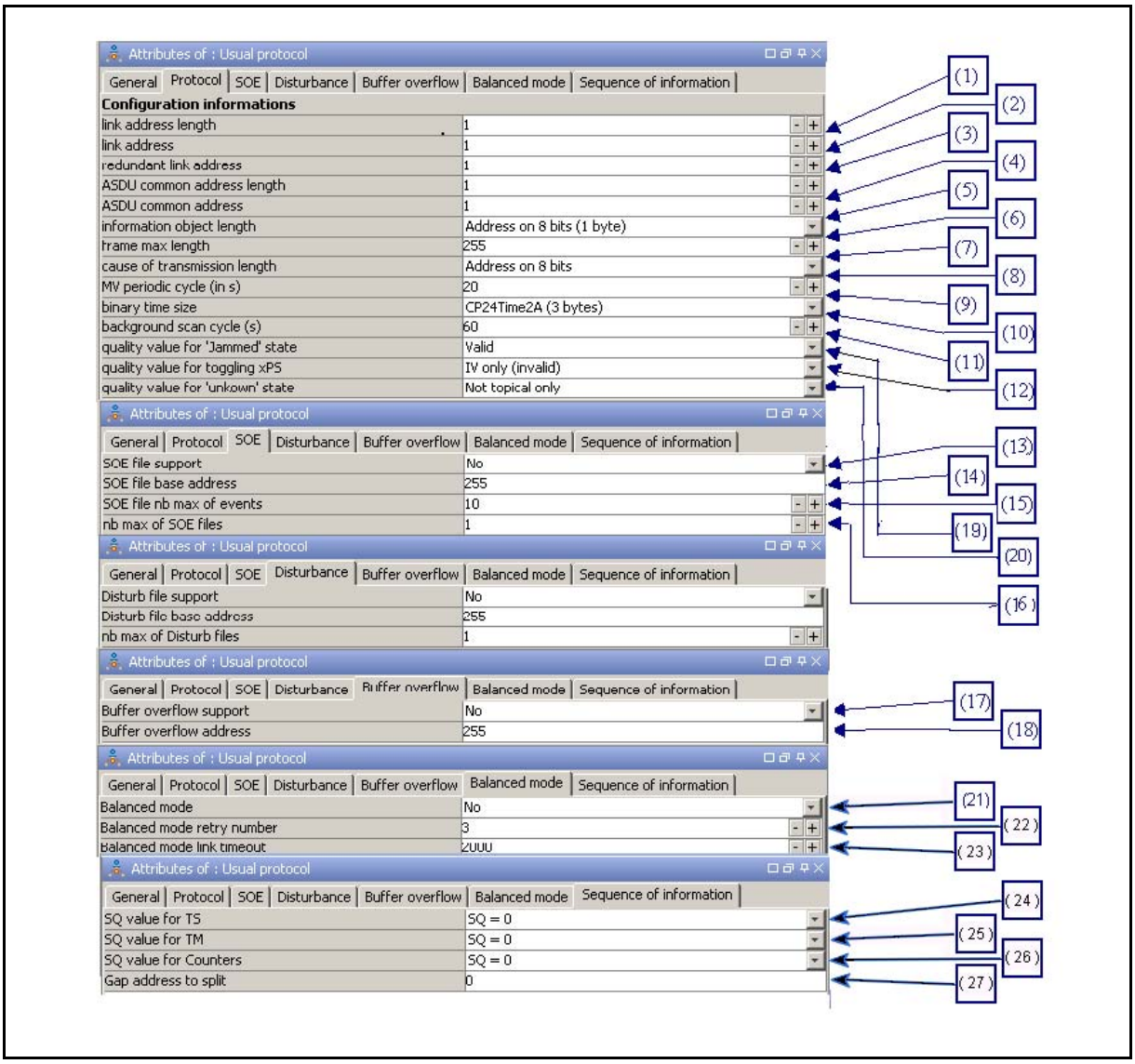

Attributes of : Usual protocol
General | Protocol | SOE | Disturbance | Buffer overflow | Balanced mode | Sequence of information
Configuration informations
link address length 1
link address 1
redundant link address 1
ASDU common address length 1
ASDU common address 1
information object length Address on 8 bits (1 byte)
frame max length 255
cause of transmission length Address on 8 bits
MV periodic cycle (in s) 20
binary time size CP24Time2A (3 bytes)
background scan cycle (s) 60
quality value for 'Jammed' state Valid
quality value for toggling xPS IV only (invalid)
quality value for 'unkown' state Not topical only
Attributes of : Usual protocol
General | Protocol | SOE | Disturbance | Buffer overflow | Balanced mode | Sequence of information
SOE file support No
SOE file base address 255
SOE file nb max of events 10
nb max of SOE files 1
Attributes of : Usual protocol
General | Protocol | SOE | Disturbance | Buffer overflow | Balanced mode | Sequence of information
Disturb file support No
Disturb file base address 255
nb max of Disturb files 1
Attributes of : Usual protocol
General | Protocol | SOE | Disturbance | Buffer overflow | Balanced mode | Sequence of information
Buffer overflow support No
Buffer overflow address 255
Attributes of : Usual protocol
General | Protocol | SOE | Disturbance | Buffer overflow | Balanced mode | Sequence of information
Balanced mode No
Balanced mode retry number 3
Balanced mode link timeout 2000
Attributes of : Usual protocol
General | Protocol | SOE | Disturbance | Buffer overflow | Balanced mode | Sequence of information
SQ value for TS SQ = 0
SQ value for TM SQ = 0
SQ value for Counters SQ = 0
Gap address to split 0
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (19) (20) (16) (17) (18) (21) (22) (23) (24) (25) (26) (27)

FIGURE 15: SETTING PROTOCOL AND SOE ATTRIBUTES OF A T101 SCADA NETWORK

NOTE : Disturbance tab-pane is reserved for future use.

4.4.1.4 Setting specific attributes of a DNP3 SCADA network

When adding a SCADA network, the supported protocol must be updated. Here, set it to '**DNP3**'. Then SCADA network tab-panes are refreshed relatively to the selected protocol.

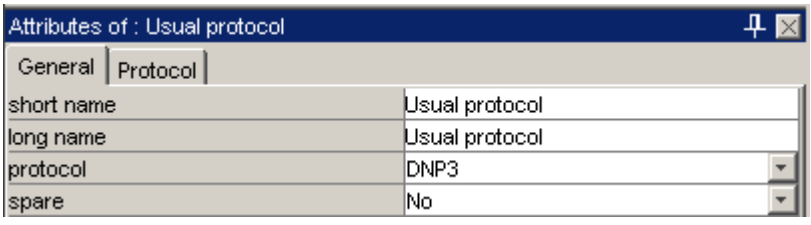


FIGURE 16: SETTING GENERAL ATTRIBUTES OF A SCADA NETWORK

When setting a DNP3 SCADA network, some specific attributes available for the protocol must be updated (Protocol tab-pane):

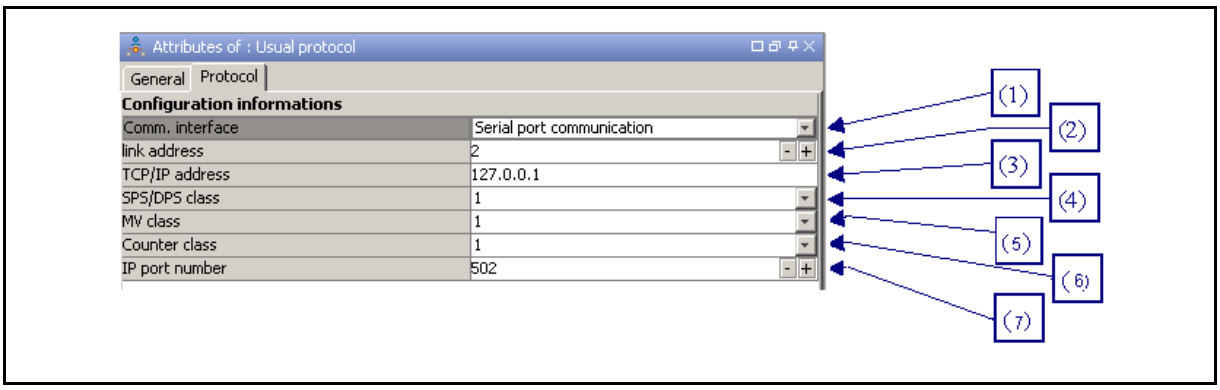


FIGURE 17: SETTING PROTOCOL TYPE OF A SCADA NETWORK

1. **Comm. Interface** (Serial port communication / UDP / TCP/IP): Type of DNP3 communication ('DNP3 Serial Communication' or 'DNP3 TCP/IP Communication)
2. **link address**: (range [1, 65534], step 1) Link address of the slave
3. **TCP/IP address**: Ethernet address if GTW is communicating to SCADA through TCP/IP
4. **SPS/DPS class**: (1 / 2 / 3) Class for SPS/DPS datapoints
5. **MV class**: (1 / 2 / 3) Class for MV datapooints
6. **Counter class**: (1 / 2 / 3) Class for counter datapoints
7. **IP port number**: if GTW is communicating to SCADA through TCP/IP

4.4.1.5 Setting specific attributes of a T104 SCADA network

When adding a SCADA network, the supported protocol must be updated (1). Here, set it to 'T104'. For this protocol an additional attribute '**time reference**' (2) is displayed and has to be set. Available values for this attribute are UTC or local. This attributes defines which time reference is used to stamp events transmitted to SCADA.

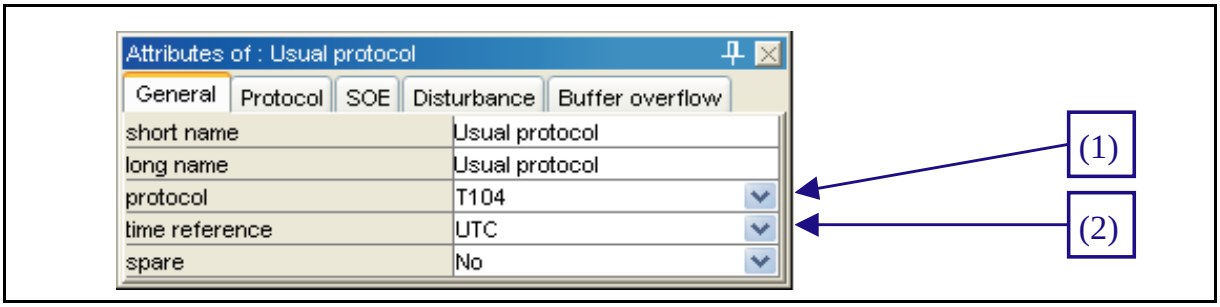


FIGURE 18: SETTING PROTOCOL TYPE OF A T104 SCADA NETWORK

When setting a T104 SCADA network, some specific attributes available for the protocol must be updated (Protocol and SOE tab-panes):

1. TCP/IP address of the GTW
2. **ASDU common address** (range [1, 65534], step 1)
3. **information object length** (Address on 8 bits.16 bits / Address on 16 bits.8 bits / Address on 8 bits.8 bits.8 bits / Address on 24 bits (3 bytes))
4. **MV** periodic **cycle** (range [0 s, 65534 s], step 1 s)
5. **backgroun**d scan **cycle** (range [0 s, 65535 s], step 1 s)
6. **T0:** connection **time-out** (range [1 s, 255 s], step 1 s)
7. **T1: APDU time-out** (range [1 s, 255 s], step 1 s)
8. **T2: acknowledgement** time**-out** (range [1 s, 255 s], step 1 s)
9. **T3: test frame time-out** (range [1 s, 255 s], step 1 s)
10. **K: sent unack. frames (window size)** (range [1, 255], step 1)
11. **W: ack. received frames (window** size**)** (range [1, 255], step 1)
12. **max command delay** (range [0 s, 32767 s], step 1 s)
13. **quality value for '**Jammed' state: (Valid/ Invalid) this attribute defines the value of the Quality Descriptor field when the event to transmit is an xPS in the 'Jammed' State.
14. **quality value for toggling xPS**(BL only (blocked) / IV only (invalid) : this attribute defines the value of the Quality Descriptor field when the event to transmit is an xPS in the ‘Toggling’ state.
15. **quality value for 'unknown' state:** (Not topical/ Not topical and IV invalid) this attribute defines the value of the Quality Descriptor field when the event to transmit is an xPS in the 'Unknown' State.
16. **SOE file support** (No / Yes (Standard) / Yes (Microsol)): set to ‘Yes’ if SOE file management is supported by the SCADA.
17. **SOE file base address**: this attribute is significant only if **SOE file support** is not set to No.
18. **SOE file nb max of events** (range [10,4200], step 1): this attribute is significant only if **SOE file support** is not set to No.
19. **nb max of SOE files** (range [1,99], step 1): this attribute is significant only if **SOE file** support is not set to No.
20. **Disturb file upl**oad (No / Yes: this attributes defines if the disturbance file is managed. If set to Yes the following attribute is significant and has to be updated.
21. **Disturb file base address**
22. **Nb max of** disturb **files**
23. **Buffer overflow** support (No / Yes): this attributes defines if the buffer overflow is managed. If set to Yes the following attribute is significant and has to be updated.
24. **Buffer** overflow **address** (No / Yes): this attributes defines the address of the buffer overflow datapoint sent to SCADA.

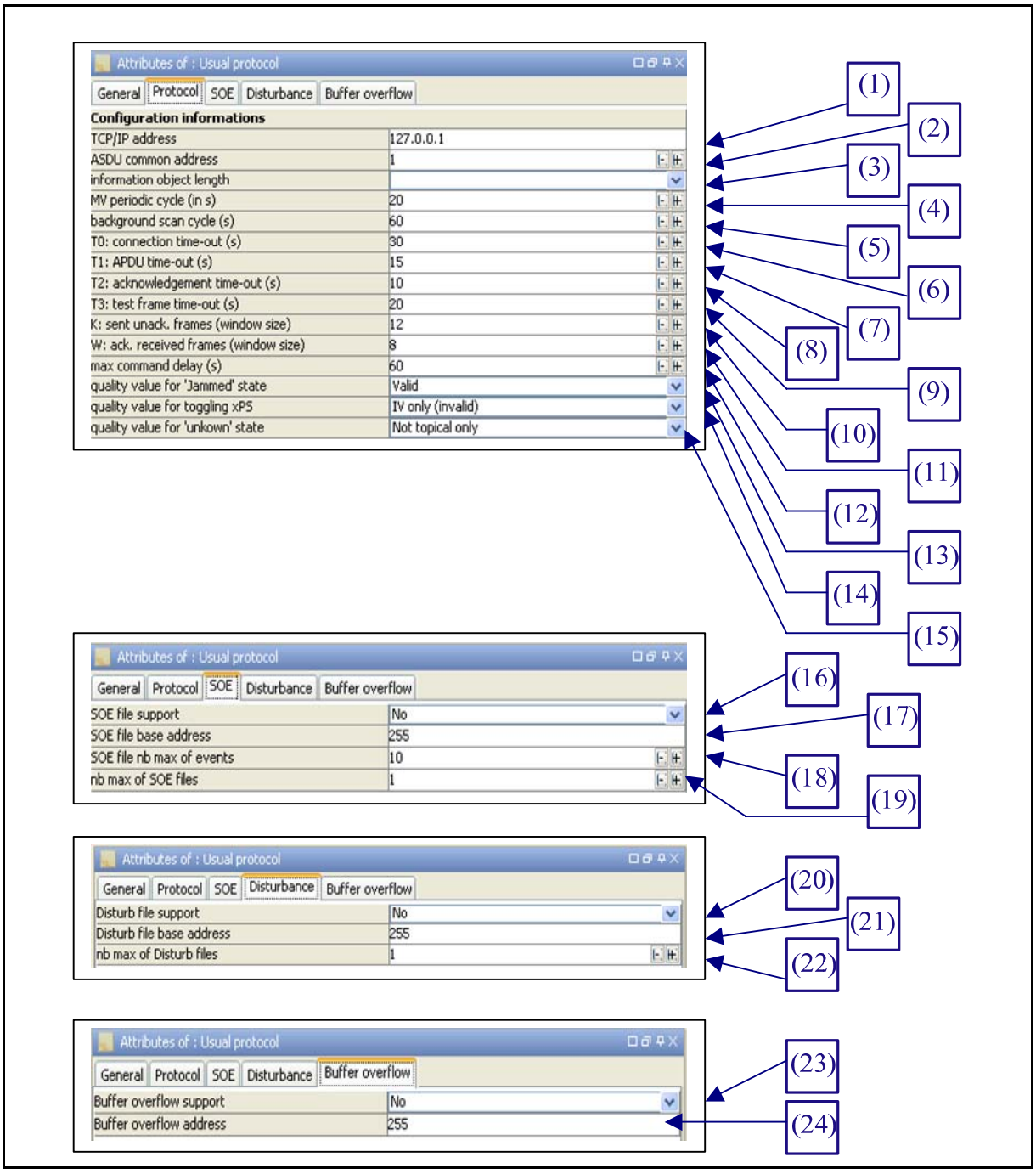


FIGURE 19: SETTING PROTOCOL AND SOE ATTRIBUTES OF A T104 SCADA NETWORK

Configuration rules and checks

- The following constraints between the attributes must be respected:
  "SOE file nb of events" > "'full' SOE file nb of events"
  "T2" < "T1"
  "T3" > "T1"
  "W" ≤ "K"

4.4.1.6 Setting specific attributes of a MODBUS SCADA network

When adding a SCADA network, the supported protocol must be updated. Then SCADA network tab-panes depend the selected protocol.

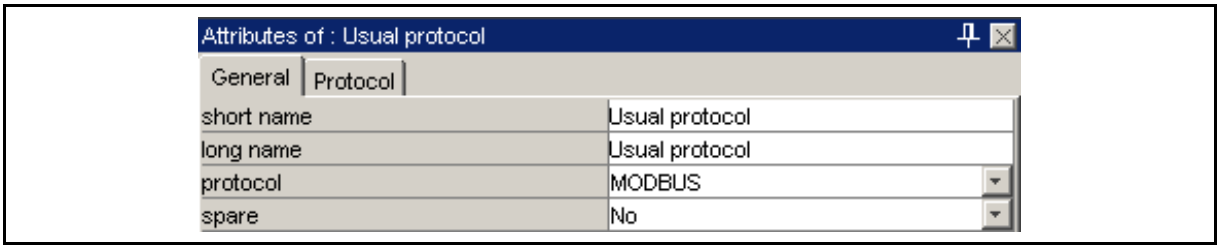


FIGURE 20: SETTING PROTOCOL TYPE OF A MODBUS SCADA NETWORK

When setting a MODBUS SCADA network, some specific attributes available for the protocol must be updated (**Protocol** tab-pane):

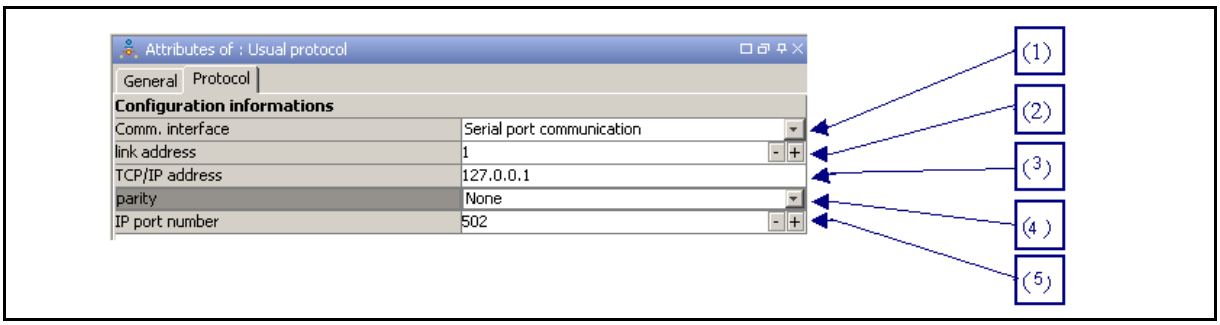


FIGURE 21: SETTING SPECIFIC ATTRIBUTES OF A MODBUS SCADA NETWORK

1. **Comm. Interface*** (Serial port communication / Modbus TCP/IP)
2. **link address** (range [1, 247], step 1): Link address of the slave
3. **TCP/IP address**: Ethernet address (if “MODBUS TCP/IP” is selected)
4. **parity**: (None / Odd / Even) used at communication level
5. **IP port number**: if GTW is communicating through Modbus TCP/IP

CAUTION (*) : The Comm. Interface with The Modbus IP setting is reserved for future use.

4.4.1.7 Setting specific attributes of a CDC type II SCADA network

When adding a SCADA network, the supported protocol must be updated (1). Here, set it to 'CDC type II'. Then SCADA network tab-panes are refreshed relatively to the selected protocol.

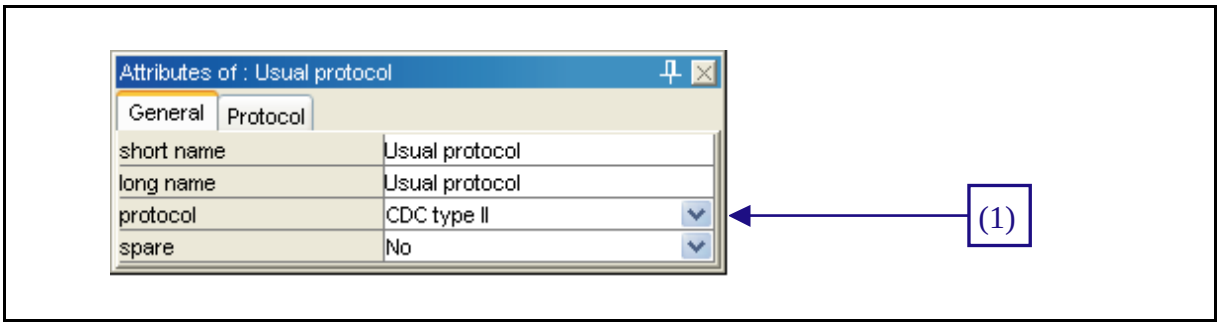


FIGURE 22: SETTING PROTOCOL TYPE OF A CDC TYPE II SCADA NETWORK

When setting a CDC type II SCADA network, some specific attributes available for the protocol must be updated (Protocol tab-pane):

1. **T0: connection time-out** (range [1 s, 255 s], step 1 s)
2. **minimal int value for MV** (range [-2048, 0], step 1)
3. **maximal int value for MV** (range [0,2047], step 1)
4. **int value for invalid MV** (None / 2047 / -2048)

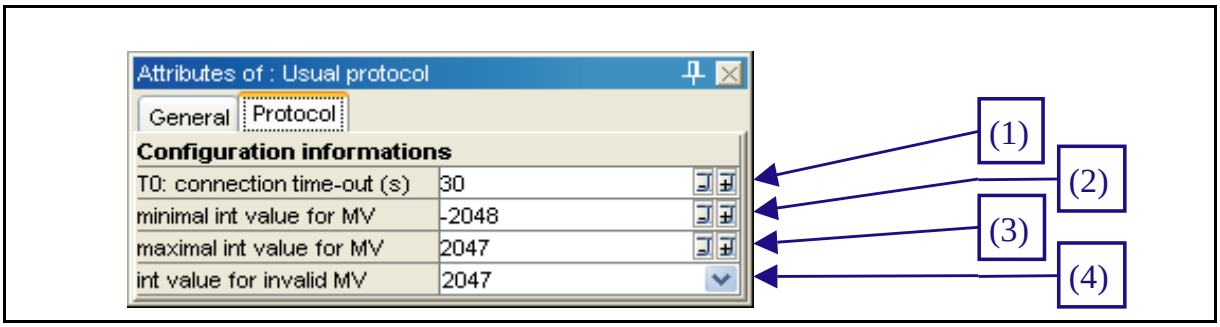


FIGURE 23: SETTING SPECIFIC ATTRIBUTES OF A CDC TYPE II SCADA NETWORK

4.4.1.8 Setting specific attributes of an OPC SCADA network

When adding a SCADA network, you can choose directly OPC Protocol. Then OPC Protocol tab-panes are refreshed relatively to the selected protocol.

When setting an OPC SCADA network, some specific attributes available for the protocol must be updated:

General tab-pane

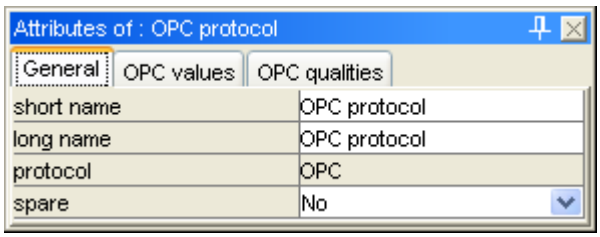


FIGURE 24: GENERAL ATTRIBUTES OF AN OPC PROTOCOL

OPC values tab pane

1. OPC value for 'Reset' (byte format): indicates the value for the Tag OPC to represent the state Reset for all SPS with the format byte (0 to 255).
2. OPC value for 'Reset' (bool format): indicates the value for the Tag OPC to represent the state Reset for all SPS with the format bool (0 for False,1 for True).
3. OPC value for 'Set' (byte format): indicates the value for the Tag OPC to represent the state Set for all SPS with the format byte (0 to 255).
4. OPC value for 'Set' (bool format): indicates the value for the Tag OPC to represent the state Jammed for all SPS with the format bool (0 for False,1 for True).
5. OPC value for 'Jammed' (byte format): indicates the value for the Tag OPC to represent the state Jammed for all DPS with the format byte (0 to 255).
6. OPC value for 'Jammed' (bool format): indicates the value for the Tag OPC to represent the state Jammed for all DPS with the format bool (0 for False,1 for True).
7. OPC value for 'Open' (byte format): indicates the value for the Tag OPC to represent the state Open for all DPS with the format byte (0 to 255).
8. OPC value for 'Open' (bool format): indicates the value for the Tag OPC to represent the state Open for all DPS with the format bool (0 for False,1 for True).
9. OPC value for 'Closed' (byte format): indicates the value for the Tag OPC to represent the state Close for all DPS with the format byte (0 to 255).
10. OPC value for 'Closed' (bool format): indicates the value for the Tag OPC to represent the state Close for all DPS with the format bool (0 for False,1 for True).
11. OPC value for 'Undefined' (byte format): indicates the value for the Tag OPC to represent the state Undefined for all DPS with the format byte (0 to 255).
12. OPC value for 'Undefined' (bool format): indicates the value for the Tag OPC to represent the state Undefined for all DPS with the format bool (0 for False,1 for True).
13. OPC value for 'Order open' (byte format): indicates the value for the Tag OPC to represent the state order open for all DPC with the format byte (0 to 255).
14. OPC value for 'Order open' (bool format): indicates the value for the Tag OPC to represent the state order open for all DPC with the format bool (0 for False,1 for True).
15. OPC value for 'Order close' (byte format): indicates the value for the Tag OPC to represent the state order close for all DPC with the format byte (0 to 255).

16. OPC value for ‘Order close’ (bool format): indicates the value for the Tag OPC to represent the state order close for all DPC with the format bool (0 for False,1 for True).

17. OPC value for ‘Order reset’ (byte format): indicates the value for the Tag OPC to represent the state order reset for all SPC with the format byte (0 to 255).

18. OPC value for ‘Order reset’ (bool format): indicates the value for the Tag OPC to represent the state order reset for all SPC with the format bool (0 for False,1 for True).

19. OPC value for ‘Order set’ (byte format): indicates the value for the Tag OPC to represent the state order set for all SPC with the format byte (0 to 255).

20. OPC value for ‘Order set’ (bool format): indicates the value for the Tag OPC to represent the state order set for all SPC with the format bool (0 for False,1 for True).

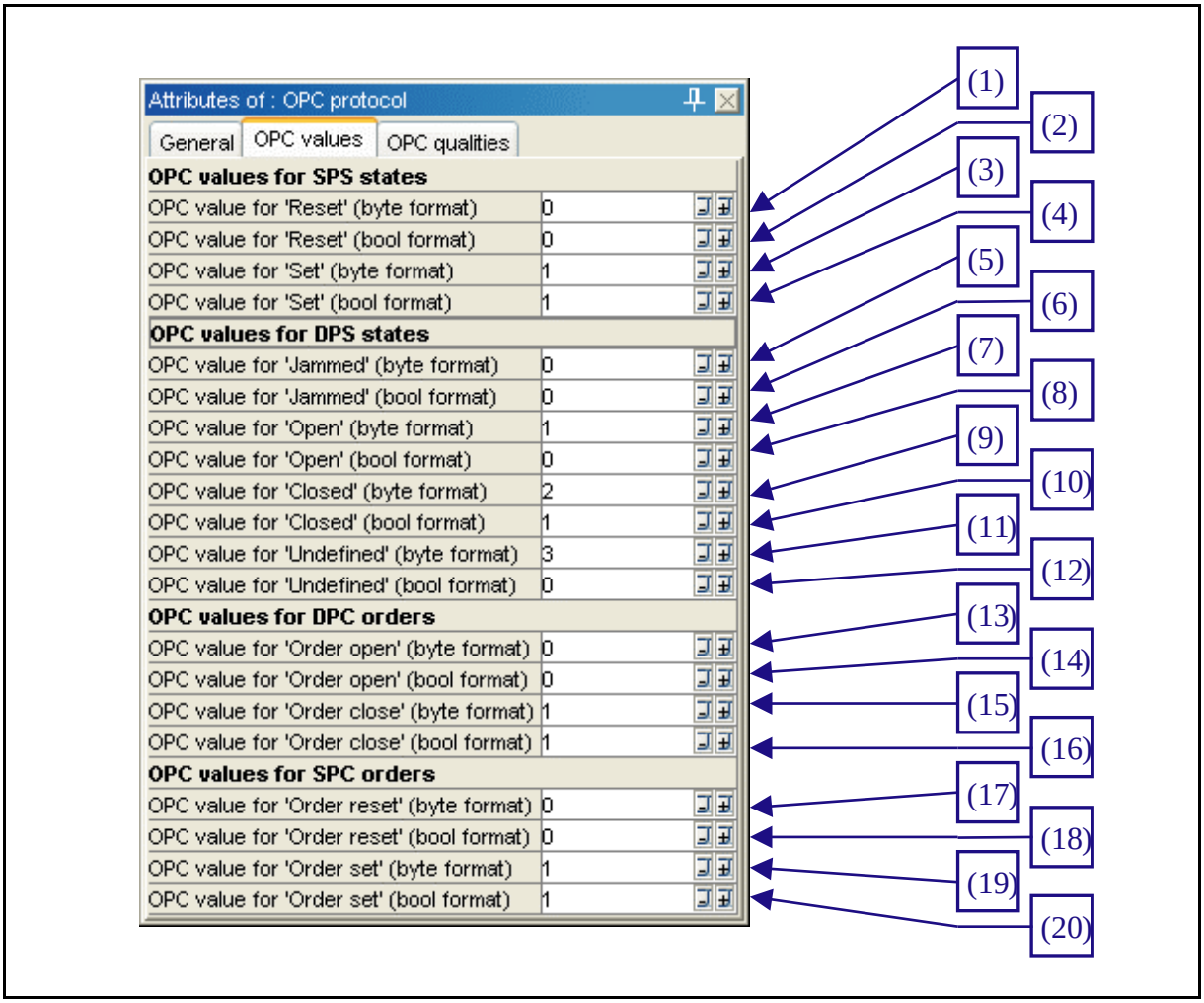

Attributes of : OPC protocol
General
OPC values
OPC qualities
OPC values for SPS states
OPC value for 'Reset' (byte format) 0
OPC value for 'Reset' (bool format) 0
OPC value for 'Set' (byte format) 1
OPC value for 'Set' (bool format) 1
OPC values for DPS states
OPC value for 'Jammed' (byte format) 0
OPC value for 'Jammed' (bool format) 0
OPC value for 'Open' (byte format) 1
OPC value for 'Open' (bool format) 0
OPC value for 'Closed' (byte format) 2
OPC value for 'Closed' (bool format) 1
OPC value for 'Undefined' (byte format) 3
OPC value for 'Undefined' (bool format) 0
OPC values for DPC orders
OPC value for 'Order open' (byte format) 0
OPC value for 'Order open' (bool format) 0
OPC value for 'Order close' (byte format) 1
OPC value for 'Order close' (bool format) 1
OPC values for SPC orders
OPC value for 'Order reset' (byte format) 0
OPC value for 'Order reset' (bool format) 0
OPC value for 'Order set' (byte format) 1
OPC value for 'Order set' (bool format) 1
(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)
(11)
(12)
(13)
(14)
(15)
(16)
(17)
(18)
(19)
(20)

FIGURE 25: SETTING OPC VALUES ATTRIBUTES OF AN OPC SCADA NETWORK

OPC qualities tab pane

1. OPC quality for ‘SelfCheckFault’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to SelfCheckFault for all datapoints (0 to 65535).
2. OPC quality for ‘Unknown’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Unknown for all datapoints (0 to 65535).
3. OPC quality for ‘Toggling’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Toggling for all datapoints (0 to 65535).
4. OPC quality for ‘Suppressed’ indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Suppressed for all datapoints (0 to 65535).
5. OPC quality for ‘Forced’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Forced for all datapoints (0 to 65535).
6. OPC quality for ‘Substituted’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Substituted for all datapoints (0 to 65535).
7. OPC quality for ‘Undefined’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Undefined for all MPS,MV,Counter (0 to 65535).
8. OPC quality for ‘OverRange’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to OverRange for all MV,Counter (0 to 65535).
9. OPC quality for ‘OpenCircuit’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to OpenCircuit for all MV (0 to 65535).
10. OPC quality for ‘LLLThreshold’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to LLLThreshold for all MV (0 to 65535).
11. OPC quality for ‘LLThreshold’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to LLThreshold for all MV (0 to 65535).
12. OPC quality for ‘LThreshold’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to LThreshold for all MV (0 to 65535).
13. OPC quality for ‘HThreshold’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to HThreshold for all MV (0 to 65535).
14. OPC quality for ‘HHThreshold’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to HHThreshold for all MV (0 to 65535).
15. OPC quality for ‘HHHThreshold’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to HHHThreshold for all MV (0 to 65535).
16. OPC quality for ‘Jammed’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Jammed for all DPS (0 to 65535).
17. OPC quality for ‘Undefined’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Undefined for all DPS (0 to 65535).
18. OPC quality for ‘Valid Set/Closed’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Set or Closed for all SPS/DPS (0 to 65535).
19. OPC quality for ‘Valid Reset/Opened’: indicates the value for the Tag OPC quality to represent the IEC61850 quality set to Reset or Opened for all SPS/DPS (0 to 65535).

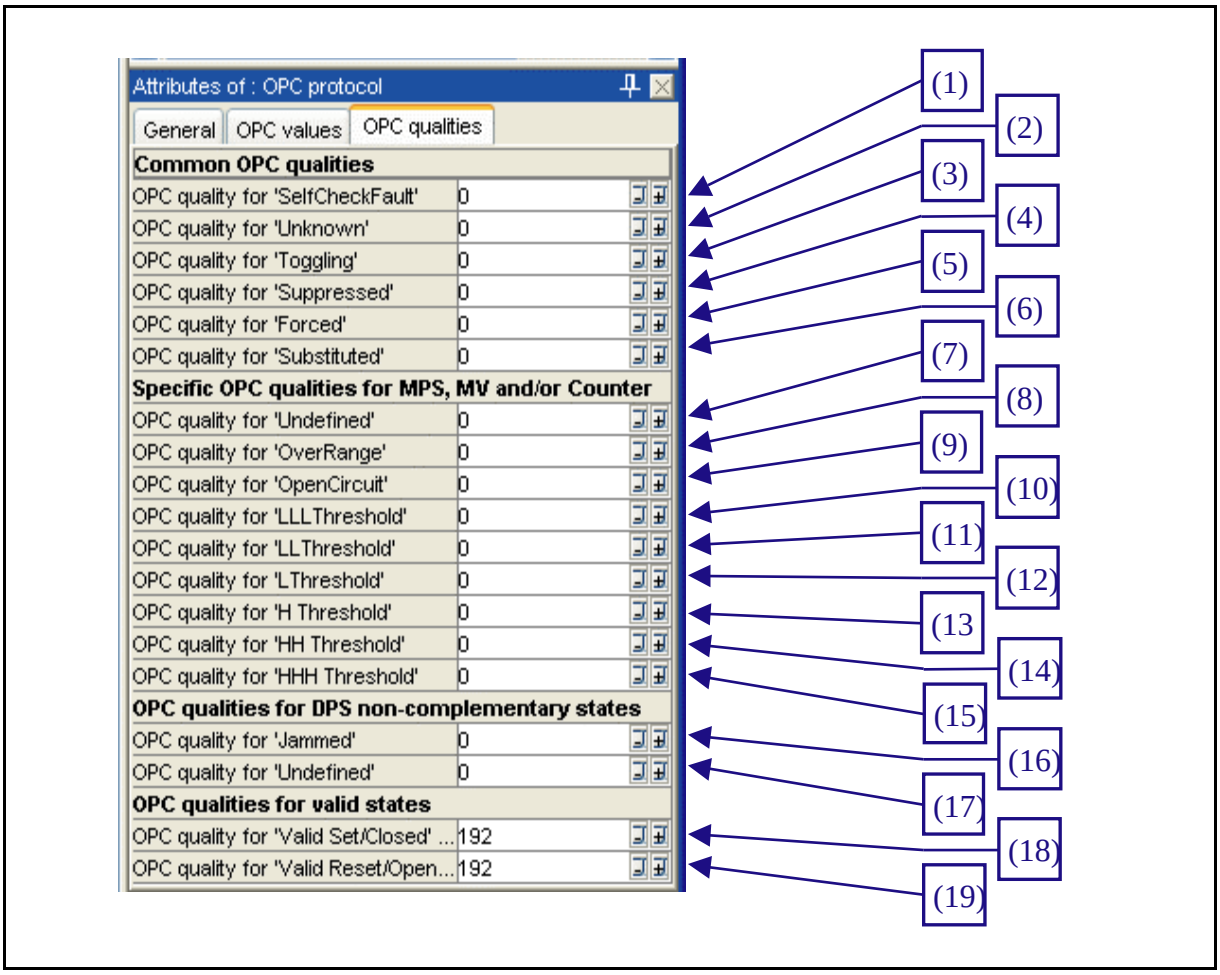


FIGURE 26: SETTING OPC QUALITIES ATTRIBUTES OF AN OPC SCADA NETWORK

4.4.1.9 Setting specific attributes of an IEC 61850 SCADA network

When setting an IEC 61850 SCADA network the following attributes must be updated:

1. **short name** and **long name**: used for logging, alarms, …
2. **TCP/IP address** of the GTW on the SCADA network
3. **Check Local/Remote** (Yes / No) of the GTW on SCADA network

This attribute "**Check Local/Remote**" defines if the SubstationLocal/Remote information has to be used by an IEC61850/IEC61850 gateway. The Substation Local/Remote xPS comes from the lower IEC61850 network.

If the L/R is managed (attribute to YES), the controls coming from the upper network:

- are sent to the lower network if the Substation mode is “Remote” and if the controls are dependant of the L/R mode.
- are sent to the lower network if the controls are independant of the L/R mode.
- are negatively acknowledged (“bay-substation mode fault” ack) if the Substation mode is “Local” and if the controls are dependant of the L/R mode

If the L/R is not managed (attribute to NO), the controls coming from the upper network are sent to the lower network whatever is the L/R state.

Configuration rules and checks

- The "TCP/IP address" value of a device must be unique among all the devices per Ethernet Network.

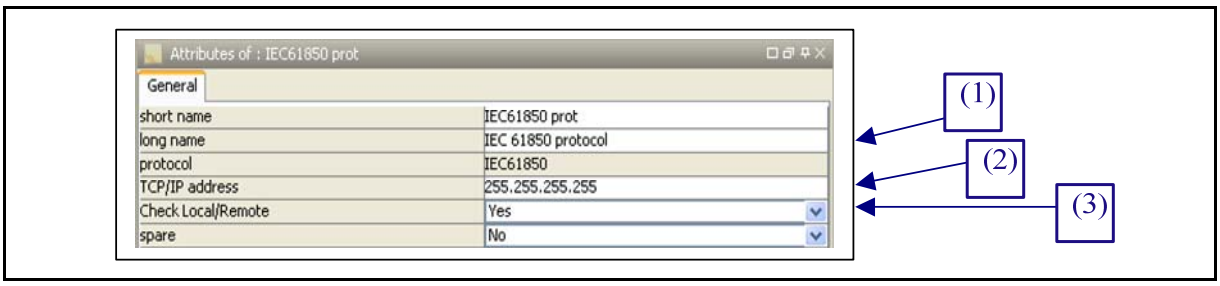


FIGURE 27: SETTING ATTRIBUTES OF AN IEC 61850 SCADA PROTOCOL

4.4.1.10 Setting general attributes of a T101-SAS SCADA network

When adding a SCADA network, the supported protocol must be updated (1). Here, set it to 'T101-SAS'. Then SCADA network tab-panes are refreshed relatively to the selected protocol.

When setting a T101-SAS SCADA network the following attributes must be updated:

1. **short name** and **long name**: used for logging, alarms, …

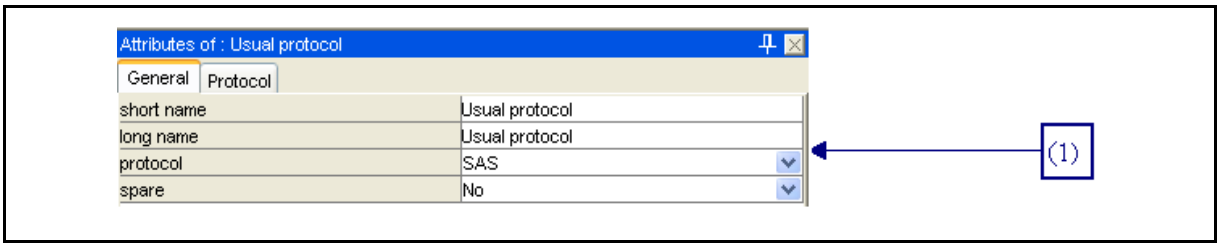


FIGURE 28: SETTING PROTOCOL TYPE OF A T101-SAS SCADA NETWORK

When setting a T101-SAS SCADA network, some specific attributes available for the protocol must be updated (Protocol tab-pane):

1. **ASDU common address length** (1 byte / 2 bytes)
2. **ASDU common address** (range [1, 65534], step 1)
3. **Address structure** (address on 8 bits .8 bits.8 bits)
4. **Frame max length** (range [1, 255], step 1)
5. **MV periodic cycle (in s)** (range [0 s, 65534 s], step 1 s)
6. **Binary time size** (CP24 Time2A 3bytes / CP56 Time2A 7bytes)

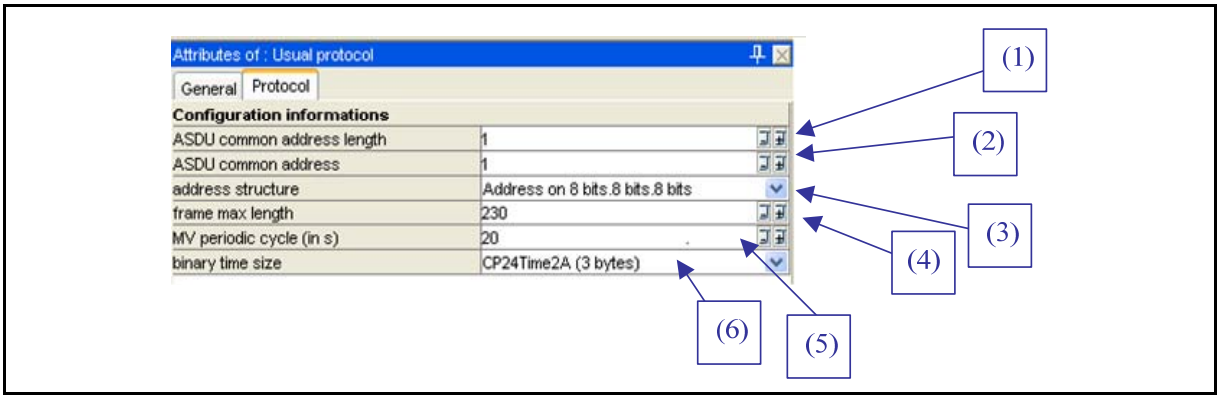


FIGURE 29: SETTING PROTOCOL OF A T101-SAS SCADA NETWORK

4.4.2 Defining addressing mapping of SCADA legacy network

To transmit information between PACiS system and SCADA, a SCADA legacy network is used. So, each concerned data must have a specific address on this network relatively to its protocol. General modelling of a SCADA legacy network address mapping can be done. At SCE level, a SCADA legacy network owns a “SCADA mapping” object, that is split in categories of mapping on a per datapoint kind basis. In each category of mapping, elementary SCADA addresses can be created. This mapping is implicitly created at SCADA network creation.

Addressing MPS datapoint on SCADA legacy network is not available.

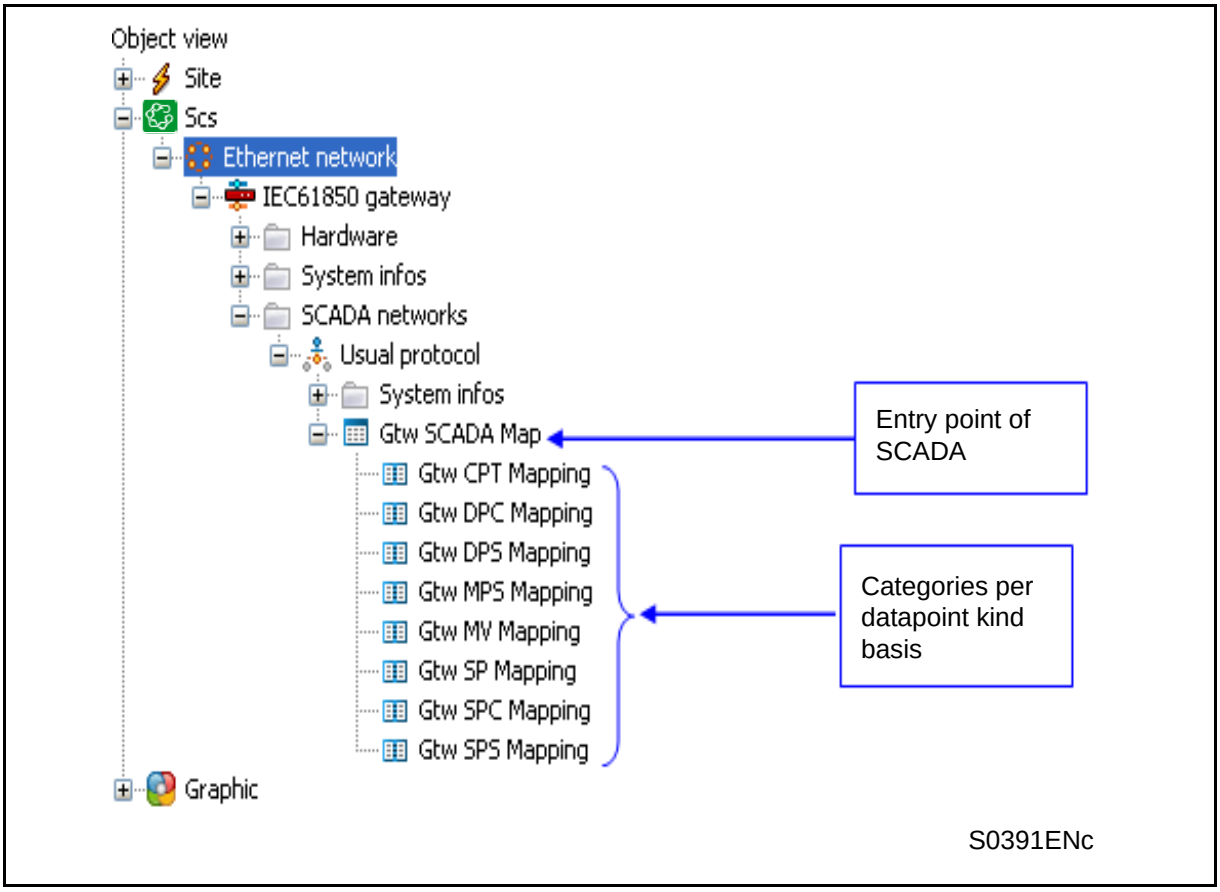


FIGURE 30: STRUCTURE OF THE ADDRESSING MAPPING OF A LEGACY SCADA NETWORK

Configuration rules and checks

- In the SCADA Mapping, the address identification of each "Gtw xxx addr." must be unique. For T101 and T104 protocols, the uniqueness constraint is applicable only for addresses of the same type. Addresses of different types can have identical addresses and therefore this does not lead to an error but to a warning.
- With a DNP3 protocol, a "Gtw MV addr.", which is the SCADA address of a "Tap pos ind" datapoint, must have its "Format" attribute set to the "Natural" value.

The addressing mapping of a SCADA legacy network can also be defined by using “Edit SCADA mapping“ This will open the list of datapoints having path, short name, long name, address, label, timetag, inversion. See SCE_HI chapter.

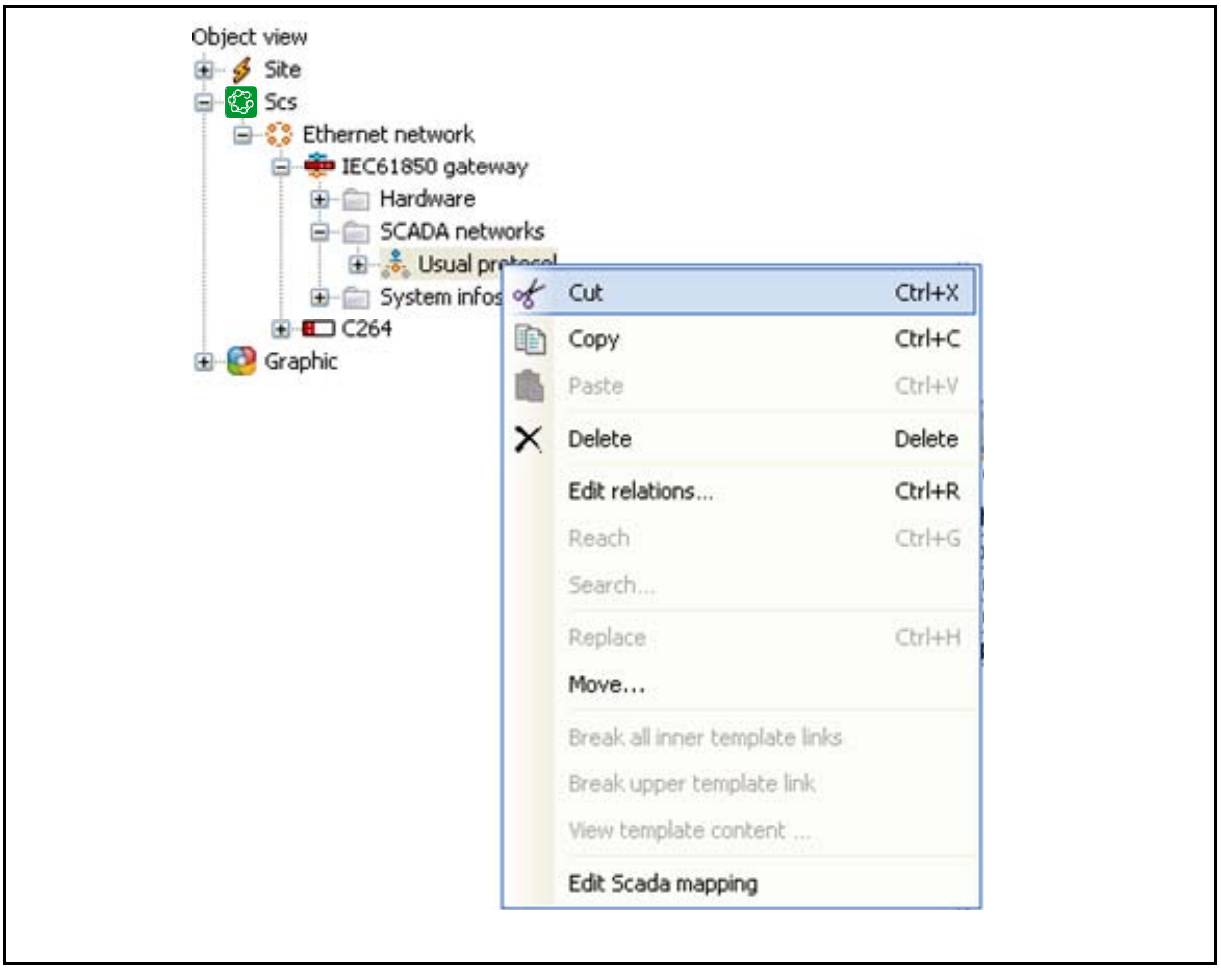


FIGURE 31: EDIT SCADA MAPPING

4.4.2.1 Defining a SCADA address for an SPS datapoint

Addition of a SCADA address for an SPS datapoint is done under SCE via the “Object entry” area at SCADA SPS mapping level by clicking on mouse’s right button.

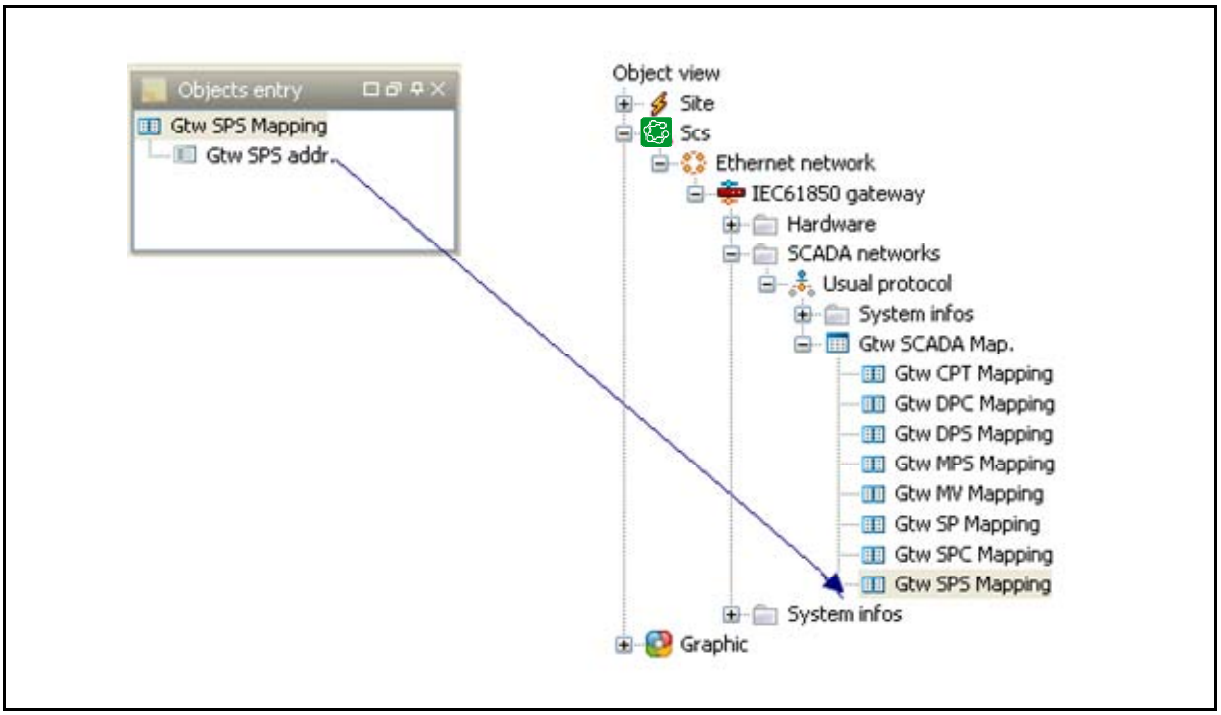


FIGURE 32: ADDING A SCADA SPS ADDRESS

Once added, SCADA SPS address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **object address**
3. **priority level** (range [1,255], step 1) gives the priority of emission (1: higher). Only significant if **Event** attribute is different from 'No'. Is fixed to 1 for T104 protocol.
4. **Event** (No / Yes with time tag / Yes without time tag): when set to 'Yes with time tag', indicates that change of state of the datapoint are transmitted spontaneously with time Tag.
5. **Event record** (Does not involved in a transfert of file / Create a RECORD EVENT if there is not it current / Add to the current record EVENT / Create a RECORD EVENT and adds to the current record EVENT): when set to a value different from 'Does not involved in a transfer of file', indicates if change of state of the datapoint must be saved in Sequence of Event file. Values different from 'Does not involved in a transfer of file' are associated to the same treatment, because only one SOE file is managed by the GTW. The set of available values is maintained for compatibility with MiCOM GTW addressing in PACiSGTW.
6. **Inversion** (No / Yes): Indicates that the datapoint value needs to be inverted before transmission.
7. **Background scan** (No / Yes): indicates if the datapoint belongs to the background scan cycle.
8. **Group ([0..16)] / 0=no group)** (range [0,16], step 1) indicates to which "T101/T104 General Interrogation group" the datapoint is assigned. 0 means 'no group' assignation.

For DNP3 protocol:

9. **object address - index**.
10. **Event** (No / Yes with time tag): when set to 'Yes with time tag', indicates if change of state of the datapoint are transmitted spontaneously with time Tag.
11. **Inversion** (No/Yes): indicates that the datapoint value needs to be inverted before transmission

For Modbus protocol:

12. **object address – register**
13. **Inversion** (No/Yes): indicates that the datapoint value needs to be inverted before transmission

For CDC type II protocol

14. **Sequence number [0…63]**
15. **OFF-offset [0…15]**
16. **CHN-device number[0…15]**
17. **Sending mode** (Static only / Event only / Static and Event)
18. **PPU- sequence of event group [1..25] (static mode only)** (range [1,25], step 1)
19. **EVT – rang in PPU [0..47] (event mode only)** (range [0,47], step 1)
20. **Inversion** (No/Yes): indicates that the datapoint value needs to be inverted before transmission.

For OPC protocol:

21. **OPC address**: indicates the name's tag for OPC (limited to 48 characters). The character "." indicates that the name is hierarchical.

22. **Historization** (No / Yes): indicates if this tag is sent at historic timer frequency (refer to section 7.3.1 of chapter GTW/EN CT).

23. **Format** (boolean / byte): indicates the type of value which is associated with the tag. Boolean is for VT_BOOL a boolean (True/False) value. A value of 0xFFFF (all bits 1) indicates True; a value of 0 (all bits 0) indicates False. No other value is valid. Byte is for VT_UI1 an unsigned 1-byte character.

24. **Inversion** (No/Yes): indicates that the datapoint value needs to be inverted before transmission

For T101-SAS protocol:

25. **short name** of the address used for internal SCE identification

26. **object address – register**

27. **Inversion** (No/Yes): indicates that the datapoint value needs to be inverted before transmission

28. **Send in GI** (No/Yes): indicates if the datapoint is included into the General Interrogation

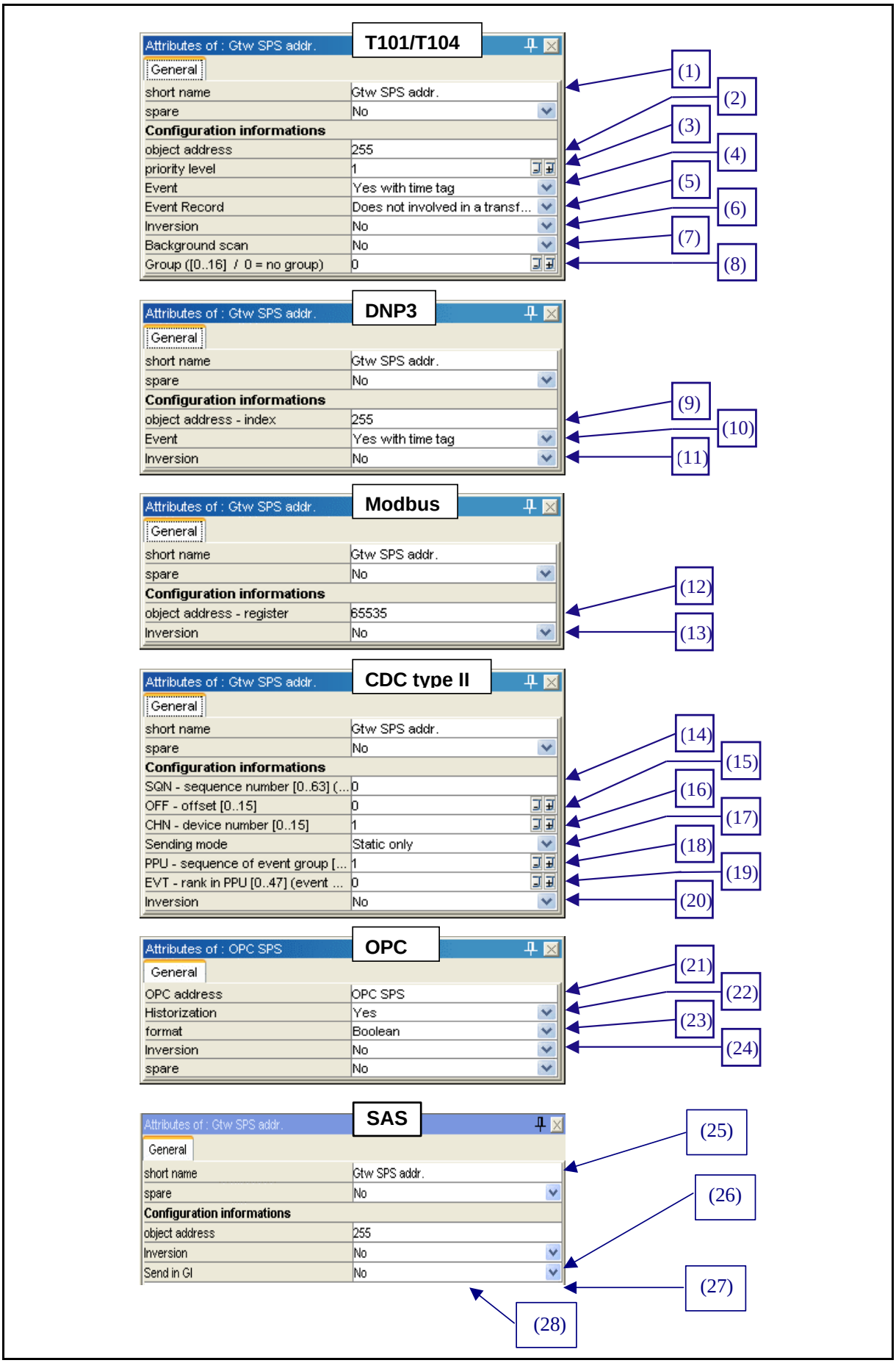


FIGURE 33: DEFINING A SCADA ADDRESS FOR AN SPS DATAPOINT

4.4.2.2 Defining a SCADA address for a DPS datapoint

Addition of a SCADA address for a DPS datapoint is done under SCE via the “Object entry” area at SCADA DPS mapping level by clicking on mouse’s right button.

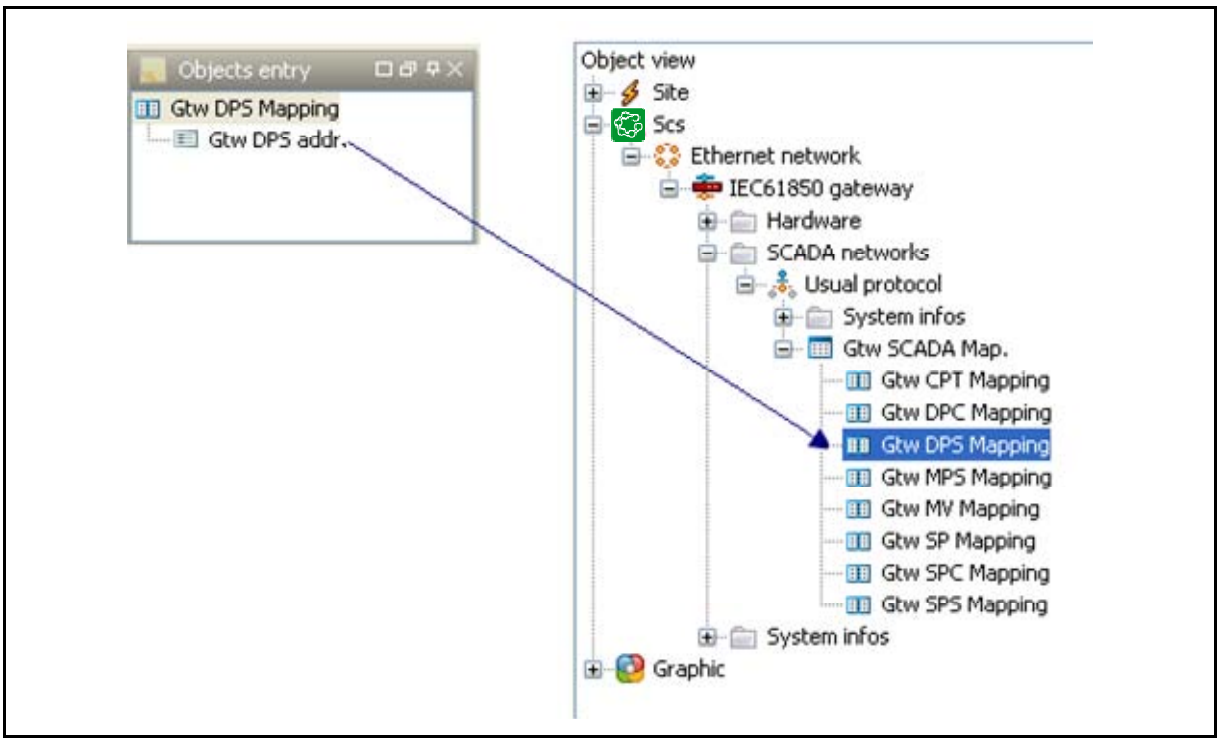


FIGURE 34: ADDING A SCADA DPS ADDRESS

Once added, SCADA DPS address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101 protocol:

2. **priority level** (from 1 to 255): gives the priority of emission (1: higher). Only significant if **Event** attribute is different from ‘No’. Is fixed to 1 for T104 protocol.

3. **Event** (No / Yes with time tag / Yes without time tag): when set to ‘Yes with time tag’ (resp. ‘Yes without time tag’) indicates if change of state of the datapoint are transmitted spontaneously with (resp. without) time tag

4. **Event record** (Does not involved transfert of file / Create a RECORD EVENT if there is not it current / Add to the current record EVENT / Create a RECORD EVENT and adds to the current record EVENT):

   when set to a value different from ‘Does not involved in a transfer of file’ indicates if change of state of the datapoint must be saved in Sequence of Event file.

   Values different from ‘Does not involved in a transfer of file’ are associated to the same treatment, because only one SOE file is managed by the GTW. The set of available values is maintained for compatibility with MiCOM GTW addressing in PACiS GTW.

5. Inversion (No/Yes): indicates that the datapoint value needs to be inverted before transmission

6. **Background scan** (No/Yes): indicates if the datapoint belongs to the background scan cycle

7. **Group ([0..16]) / 0 = no group)**: indicates to which “T101/T104 General Interrogation group” the datapoint is assigned. 0 means ‘no group’ assignation

8. **object address**: for PACiS GTW, only one address is useable to transmit DPS value.

For DNP3 protocol:

9. **Event** (No / Yes with time tag): when set to 'Yes with time tag' indicates if changes of state of the datapoint are transmitted spontaneously with time tag

10. Inversion (No/Yes): indicates that the datapoint value needs to be inverted before transmission

11. object address: index

For Modbus protocol:

12. Inversion (No/Yes): indicates that the datapoint value needs to be inverted before transmission

13. **object address - register**: for PACiS GTW, only one address is useable to transmit a DPS value.

For CDC type II protocol:

14. **Sending mode** (Static only / Event only / Static and Event)

15. Inversion (No/Yes): indicates that the datapoint value needs to be inverted before transmission

16. **SQN – sequence number 50..63] (static mode only):**

17. **OFF – offset [0..15]:**

18. **CHN – device number [0..15]**

19. **PPU – sequence of event group [1..25] (event mode only):**

20. **EVT – rank in PPU [0..47] (event mode only)**

For T104 protocol:

21. **priority level** (from 1 to 255): gives the priority of emission (1: higher). Only significant if **Event** attribute is different from 'No'. Is fixed to 1 for T104 protocol.

22. **Event** (No / Yes with time tag / Yes without time tag): when set to 'Yes with time tag' (resp. 'Yes without time tag') indicates if change of state of the datapoint are transmitted spontaneously with (resp. without) time tag

23. **Event record** (Does not involved transfert of file / Create a RECORD EVENT if there is not it current / Add to the current record EVENT / Create a RECORD EVENT and adds to the current record EVENT):

    when set to a value different from 'Does not involved in a transfer of file' indicates if change of state of the datapoint must be saved in Sequence of Event file.

    Values different from 'Does not involved in a transfer of file' are associated to the same treatment, because only one SOE file is managed by the GTW. The set of available values is maintained for compatibility with MiCOM GTW addressing in PACiS GTW.

24. Inversion(No/Yes): indicates that the datapoint value needs to be inverted before transmission

25. **Background scan** (No/Yes): indicates if the datapoint belongs to the background scan cycle

26. **Group ([0..16]) / 0 = no group)**: indicates to which "T101/T104 General Interrogation group" the datapoint is assigned. 0 means 'no group' assignation

27. **object address**: for PACiS GTW, only one address is useable to transmit DPS value.

For T101-SAS protocol:

28. **Inversion** (No/Yes): indicates that the datapoint value needs to be inverted before transmission

29. **Send in GI** (No/Yes): indicates if the datapoint is included into the General Interrogation

30. **object address – register**

For OPC protocol:

31. **OPC address (mono addressing)**: indicates the name's tag for OPC (limited to 48 characters). The character "." indicates that the name is hierarchical.

32. **double address usage** (No / Yes): this attribute defines if double addressing mechanism is used or not. If this attribute is set to Yes attributes (22) and (23) must be defined (refer to section 7.3.2 of chapter GTW/EN CT).

33. **Historization** (No /Yes): indicates if this tag is sent at historic timer frequency (refer to section 7.3.1 of chapter GTW/EN CT).

34. **format** (Boolean / Byte): indicates the type of value which is associated with the tag. Boolean is for VT_BOOL a boolean (True/False) value. A value of 0xFFFF (all bits 1) indicates True; a value of 0 (all bits 0) indicates False. No other value is valid. Byte is for VT_UI1 an unsigned 1-byte character.

35. **Inversion** (No / Yes): before being transmitted the value of the DPS is inverted as defined here after:
    - JAMMED (00) is replaced by UNDEFINED and vice-versa
    - OPEN (01) is replaced by CLODSE (10) and vice versa

36. **open state address**: this attribute is only significant if attribute **double address usage** is set to **Yes**. It defines the OPC tag name for the OPEN state

37. **Closed state address**: this attribute is only significant if attribute **double address usage** is set to **Yes**. It defines the OPC tag name for the CLOSE state

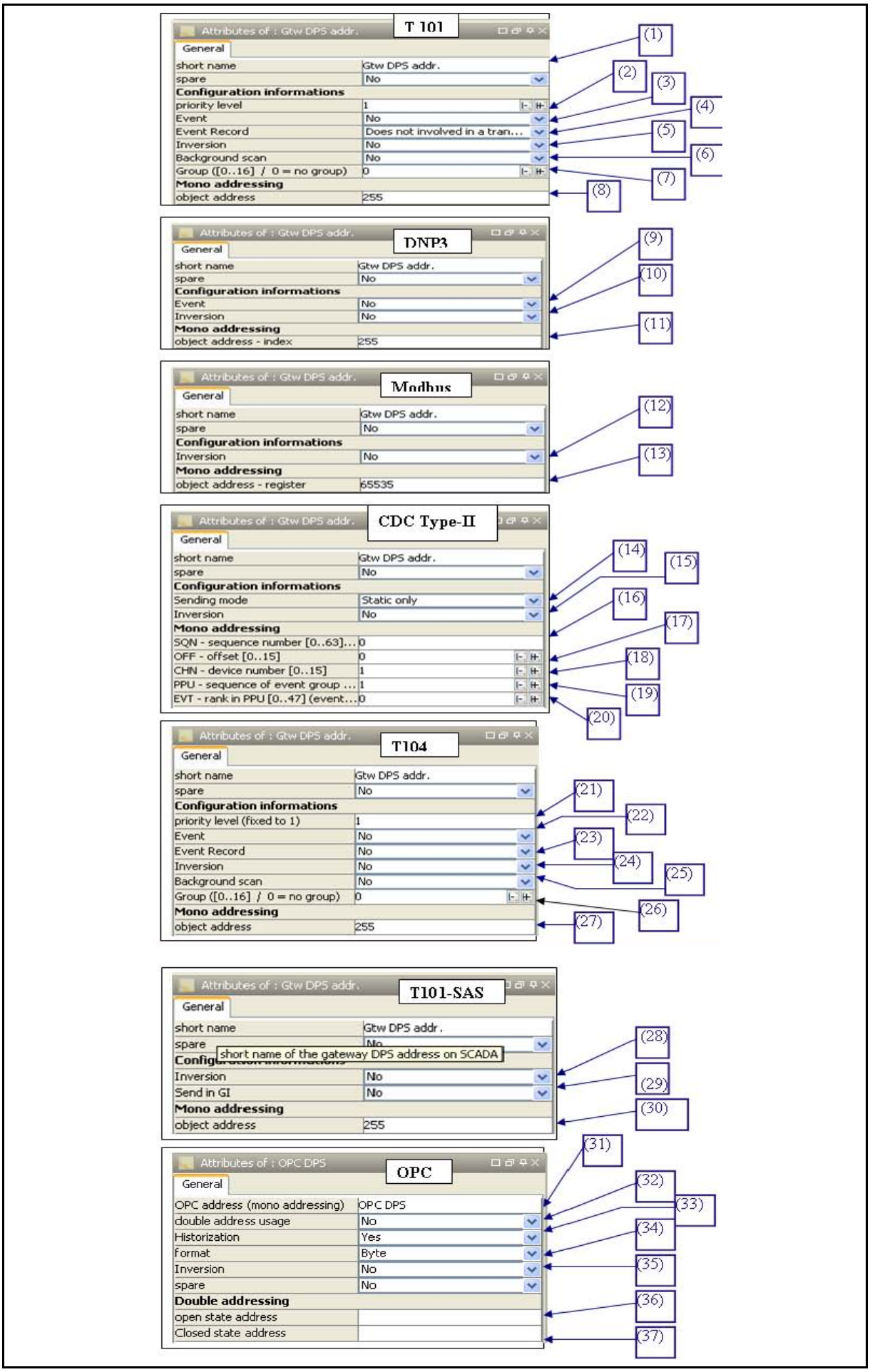


FIGURE 35: DEFINING A SCADA ADDRESS FOR A DPS DATAPOINT

4.4.2.3 Defining a SCADA address for a MV datapoint

Addition of a SCADA address for a MV datapoint is done under SCE via the “Object entry” area at SCADA MV mapping level by clicking on mouse’s right button.

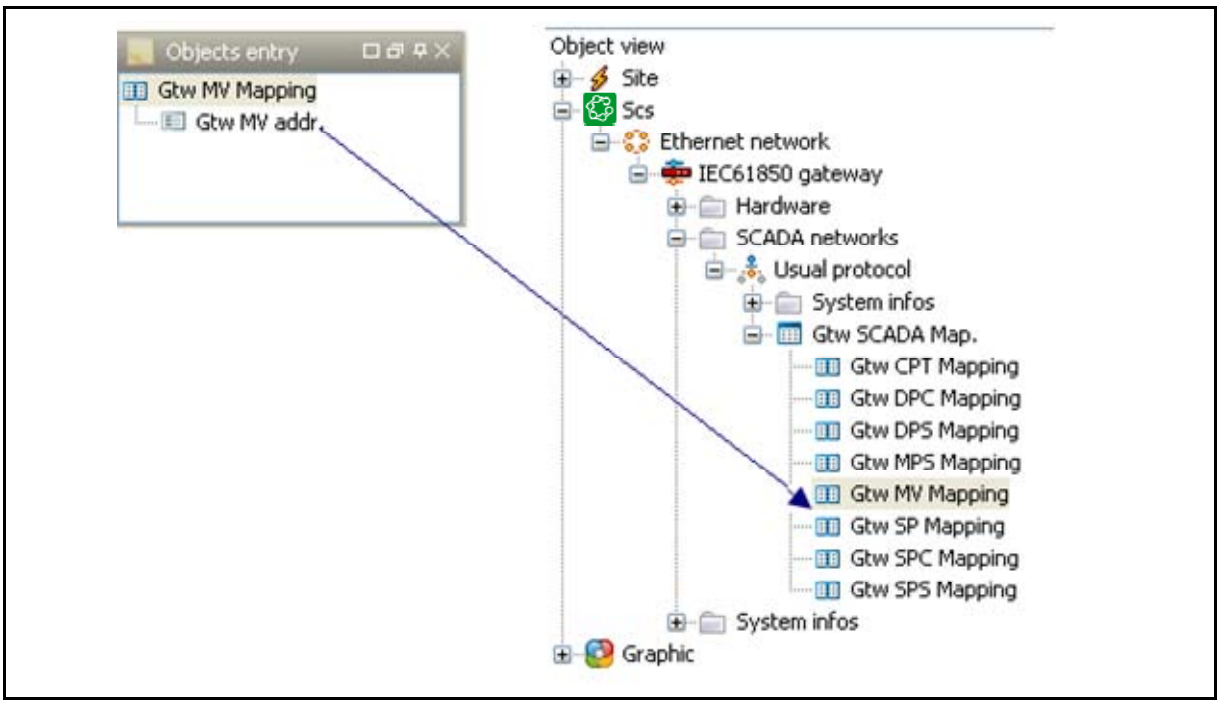


FIGURE 36: ADDING A SCADA MV ADDRESS

Once added, SCADA MV address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **object address**:
3. **priority level** (range [1,255], step 1) gives the priority of emission (1: higher). Only significant if **Event** attribute is different from ‘No’. Is fixed to 1 for T104 protocol.
4. **Event** (No / Yes with time tag / Yes without time tag): when set to ‘Yes with time tag’, indicates that changes of state of the datapoint are transmitted spontaneously with time Tag.
5. **Event record** (No / Yes): indicates if the datapoint has to be recorded in the SOE file
6. **Format** (Normalized / Adjusted / Float): transmission format.
7. **cycle type** (None / Periodic / Background scan): indicates which transmission cycle the MEAS belongs to.
8. **Group ([0..16)] / 0=no group)**: indicates to which “T101/T104 General Interrogation group” the datapoint is assigned to. 0 means ‘no group’ assignation.
9. **minimum value** (range [-3.4E38, +3.4E38]): minimum scaled value. Not used if minimum value = maximum value.
10. **maximum value** (range [-3.4E38, +3.4E38]): maximum scaled value. Not used if minimum value = maximum value.

For DNP3 protocol:

11. **object address [0..65535]**.
12. **Event** (No / Yes with time tag): when set to 'Yes with time tag', indicates if changes of state of the datapoint are transmitted spontaneously with time Tag.
13. **Format** (Natural / Adjusted).
14. **minimum value** (range [-3.4E38, +3.4E38]): minimum scaled value. Not used if minimum value = maximum value.
15. **maximum value** (range [-3.4E38, +3.4E38]): maximum scaled value. Not used if minimum value = maximum value
16. **defined as counter (** Yes/ No**)**.

For Modbus protocol:

17. **object address - register**
18. **Format** (Natural / Unsigned normalized / Signed normalized): transmission format.
19. **Precision (8..16)** (range [8,16),step 1): number of transmitted bits.
20. **minimum value** (range [-3.4E38, +3.4E38]): minimum scaled value. Not used if minimum value = maximum value.
21. **maximum value** (range [-3.4E38, +3.4E38]): maximum scaled value. Not used if minimum value = maximum value.:

For CDC type II protocol:

22. **SQN - sequence number [64..255]**
23. **CHN - device number [0..15]** (range [0,15], step 1 except 14)
24. **minimum value** (range [-3.4E38, +3.4E38]): minimum scaled value. Not used if minimum value = maximum value.
25. **maximum value** (range [-3.4E38, +3.4E38]): maximum scaled value. Not used if minimum value = maximum value.:

For OPC protocol:

26. **OPC address**: indicates the name's tag for OPC (limited to 48 characters). The character "." indicates that the name is hierarchical. For OPC MV the format is VT_R4 (an IEEE 4-byte real value)

For T101-SAS protocol:

27. **short name** of the address used for internal SCE identification
28. **object address [0..65535]**
29. **Format** (Normalized / Ajusted / Float): transmission format
30. **cycle type** (None / Periodic): indicates which transmission cycle the MEAS belongs to
31. **minimum value** (range [-3.4E38, +3.4E38]): minimum scaled value. Not used if minimum value = maximum value
32. **maximum value** (range [-3.4E38, +3.4E38]): maximum scaled value. Not used if minimum value = maximum value

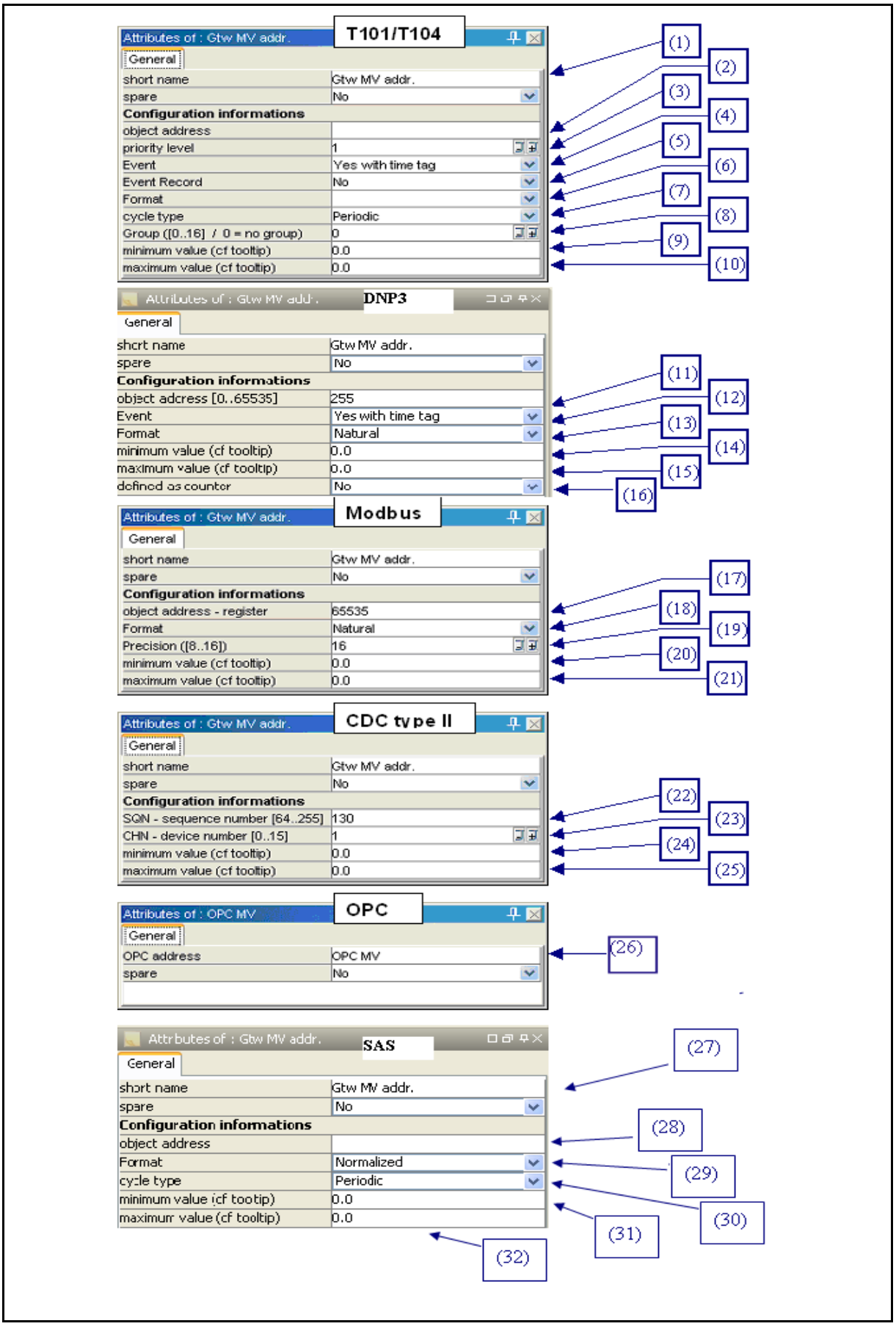


FIGURE 37: DEFINING A SCADA ADDRESS FOR A MV DATAPOINT

T101-SAS does not support measurements except Tap Position Indicator (TPI).

4.4.2.4 Defining a SCADA address for a Counter datapoint

Addition of a SCADA address for a Counter datapoint is done under SCE via the “Object entry” area at SCADA Counter mapping level by clicking on mouse’s right button.

NOTA: when one handles the counters (freeze, reset, etc....) this touches only the increase towards the SCADA, the counters are not modified on the C264 level, only on the level protocol

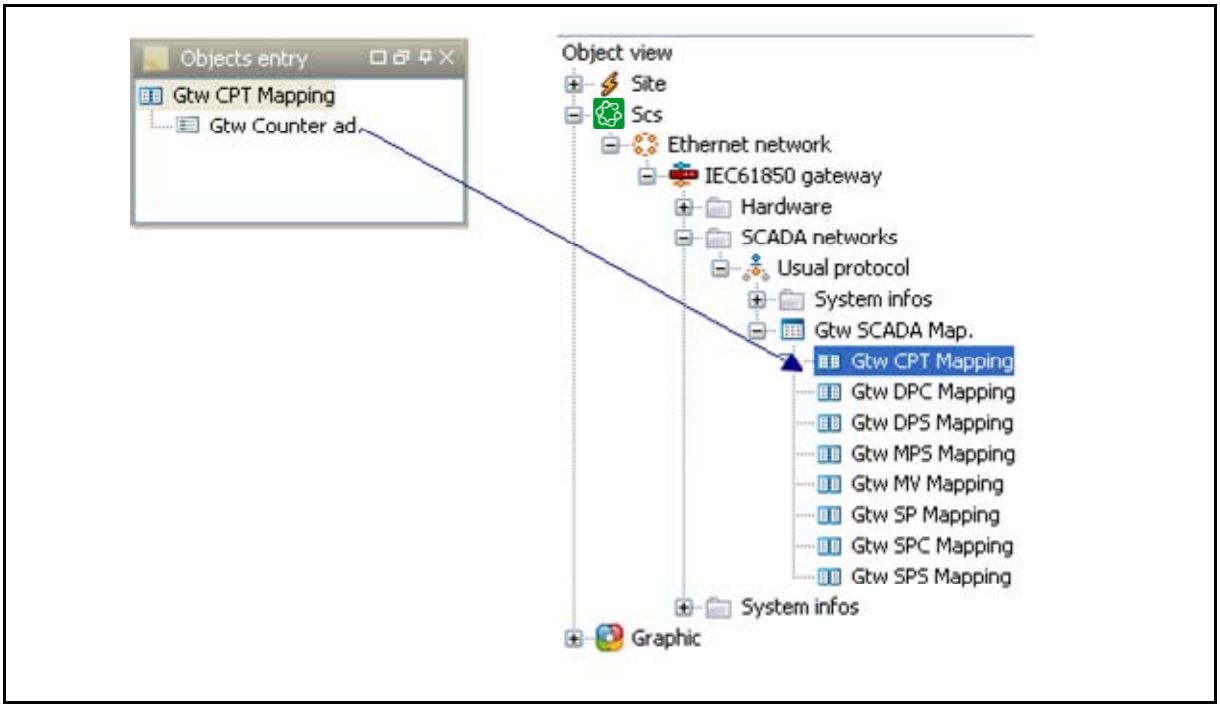


FIGURE 38: ADDING A SCADA COUNTER ADDRESS

Once added, SCADA Counter address attributes must be set at SCE level:

1. **short name** and **long name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **object address**
3. **priority level** (range [1,255], step 1) gives the priority of emission (1: higher). Only significant if **Event** attribute is different from ‘No’. Is fixed to 1 for T104 protocol.
4. **Event** (No / Yes with time tag / Yes without time tag): when set to ‘Yes with time tag’, indicates that change of state of the datapoint are transmitted spontaneously with time Tag.
5. **Event record** (No / Yes): indicates if the datapoint has to be recorded in the SOE file
6. **Group ([0..4] / 0=no group)**: indicates which “T101/T104 General Interrogation group” the datapoint is assigned to. 0 means ‘no group’ assignation.

For DNP3 protocol:

7. **object address [0..65535]**.
8. **Event** (No / Yes with time tag): when set to ‘Yes with time tag’, indicates if changes of state of the datapoint are transmitted spontaneously with time Tag.

For Modbus protocol:

9. **object address - register**
10. **Format** (Natural / Unsigned normalized): transmission format.

For CDC type II protocol:

11. **SQN - sequence number [64..255]**

12. **CHN - device number [0..15]** (range [0,15], step 1 except 14)

For OPC protocol:

13. **OPC address**: indicates the name's tag for OPC (limited to 48 characters). The character "." indicates that the name is hierarchical. For OPC counter the format is VT_I4 (a 4-bytes integer value)

For T101-SAS protocol:

14. **Object address**

T101-SAS does not support Counter datapoints.

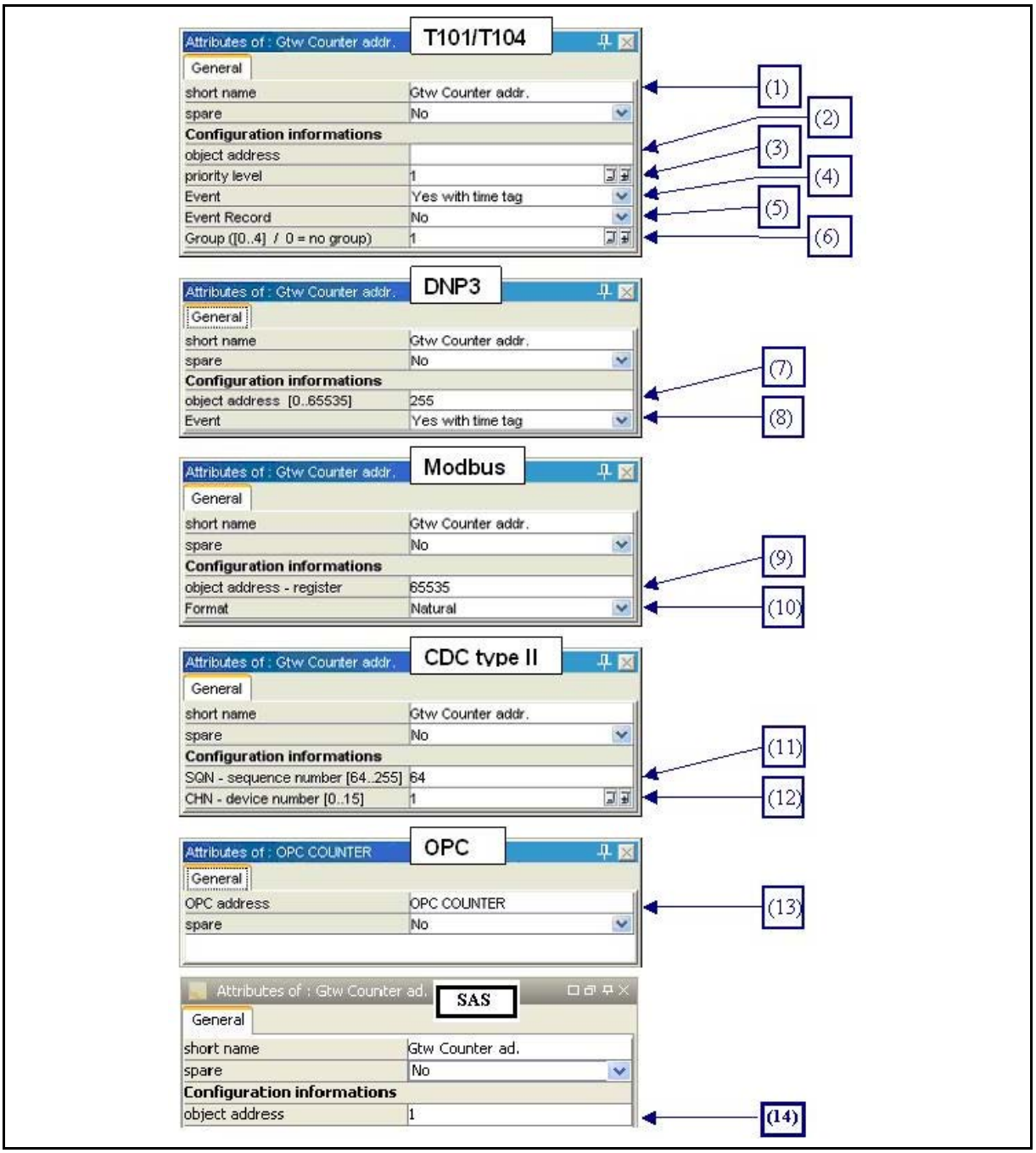


FIGURE 39: DEFINING A SCADA ADDRESS FOR A COUNTER DATAPOINT

NOTE: Energy values transmitted as counter for DNP3 & CDC II protocol.

4.4.2.5 Defining a SCADA address for a SPC datapoint

Addition of a SCADA address for a SPC datapoint is done under SCE via the “Object entry” area at SCADA SPC mapping level by clicking on mouse’s right button.

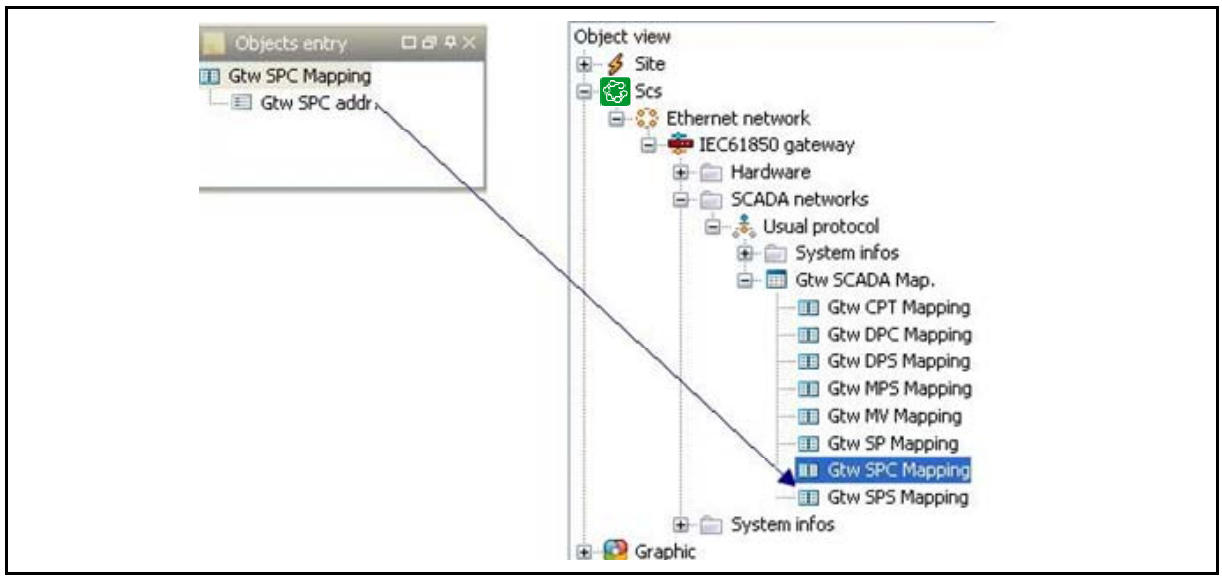


FIGURE 40: ADDING A SCADA SPC ADDRESS

Once added, SCADA SPC address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **object address**
3. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.
4. **SBO time-out** (range [0 s, 65535 s], step 1 s): time-out PACiS system has to acknowledge the selection.

For DNP3 protocol:

5. **object address [0..65535]**
6. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.

For Modbus protocol:

7. **object address - register**

For CDC type II protocol:

8. **SQN - block number [0..63]**
9. **CHN - device number [0..15]** (range [0,15], step 1 except 14)
10. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.

For OPC protocol:

11. **OPC address**: indicates the name’s tag for OPC (limited to 48 characters). The character “.” indicates that the name is hierarchical.
12. **format** (Boolean/Byte): indicates the type of value associated to the tag. Boolean is for VT_BOOL a boolean (True/False) value. A value of 0xFFFF (all bits 1) indicates True; a value of 0 (all bits 0) indicates False. No other value is valid. Byte is for VT_UI1 an unsigned 1-byte character.

For T101-SAS Protocol

The T101-SAS protocol does not support SPC commands from SCADA to gateway.

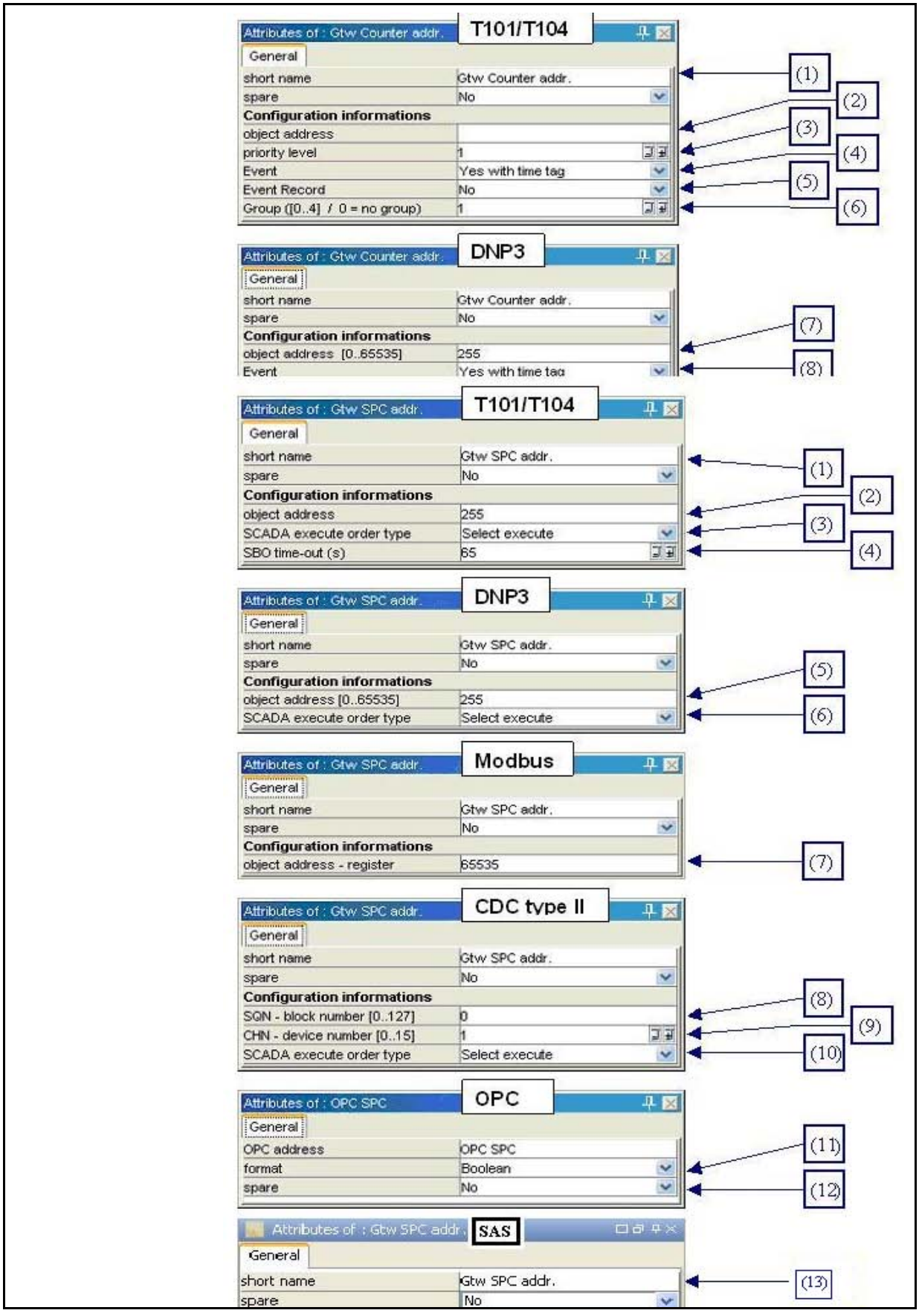


FIGURE 41: DEFINING A SCADA ADDRESS FOR AN SPC DATAPOINT

4.4.2.6 Defining a SCADA address for a DPC datapoint

Addition of a SCADA address for a DPC datapoint is done under SCE via the “Object entry” area at SCADA DPC mapping level by clicking on mouse’s right button.

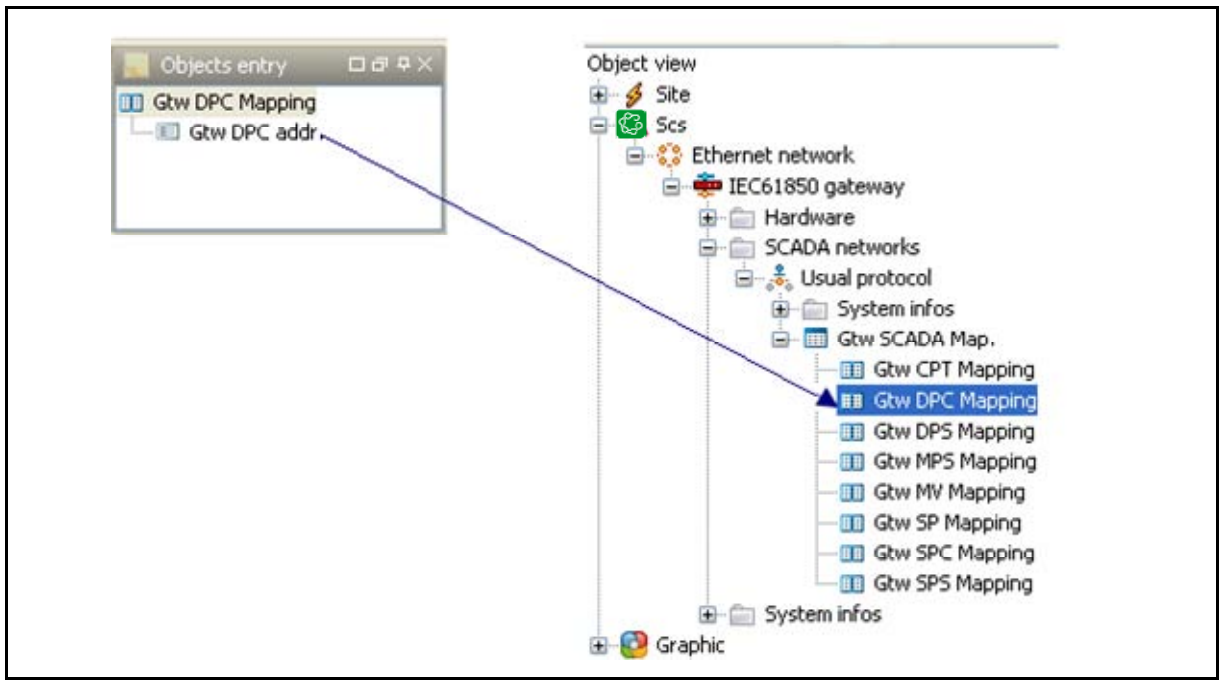


FIGURE 42: ADDING A SCADA DPC ADDRESS

Once added, SCADA DPC address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **object address**
3. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.
4. **SBO time-out** (range [0 s, 65535 s], step 1 s): time-out PACiS system has to acknowledge the selection.

For DNP3 protocol:

5. **object address [0..65535]**
6. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.

For Modbus protocol:

7. **object address - register**

For CDC type II protocol:

8. **SQN - block number [0..63]**
9. **CHN - device number [0..15]** (range [0,15], step 1 except 14)
10. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.

For OPC protocol:

11. **OPC address**: indicates the name's tag for OPC (limited to 48 characters). The character "." indicates that the name is hierarchical.

12. **double address usage** (No / Yes): this attribute defines if double addressing mechanism is used or not. If this attribute is set to Yes attributes (22) and (23) must be defined (refer to section 7.3.2 of chapter GTW/EN CT).

13. **format** (Boolean/Byte): indicates the type of value associated to the tag. Boolean is for VT_BOOL a boolean (True/False) value. A value of 0xFFFF (all bits 1) indicates True; a value of 0 (all bits 0) indicates False. No other value is valid. Byte is for VT_UI1 an unsigned 1-byte character.

14. **open order address**: this attribute is only significant if attribute **double address usage** is set to **Yes**. It defines the OPC tag name for the OPEN state

15. **Closed order address**: this attribute is only significant if attribute **double address usage** is set to **Yes**. It defines the OPC tag name for the CLOSE state

For T101-SAS Protocol:

The T101-SAS protocl does not support DPC commands from SCADA to gateway.

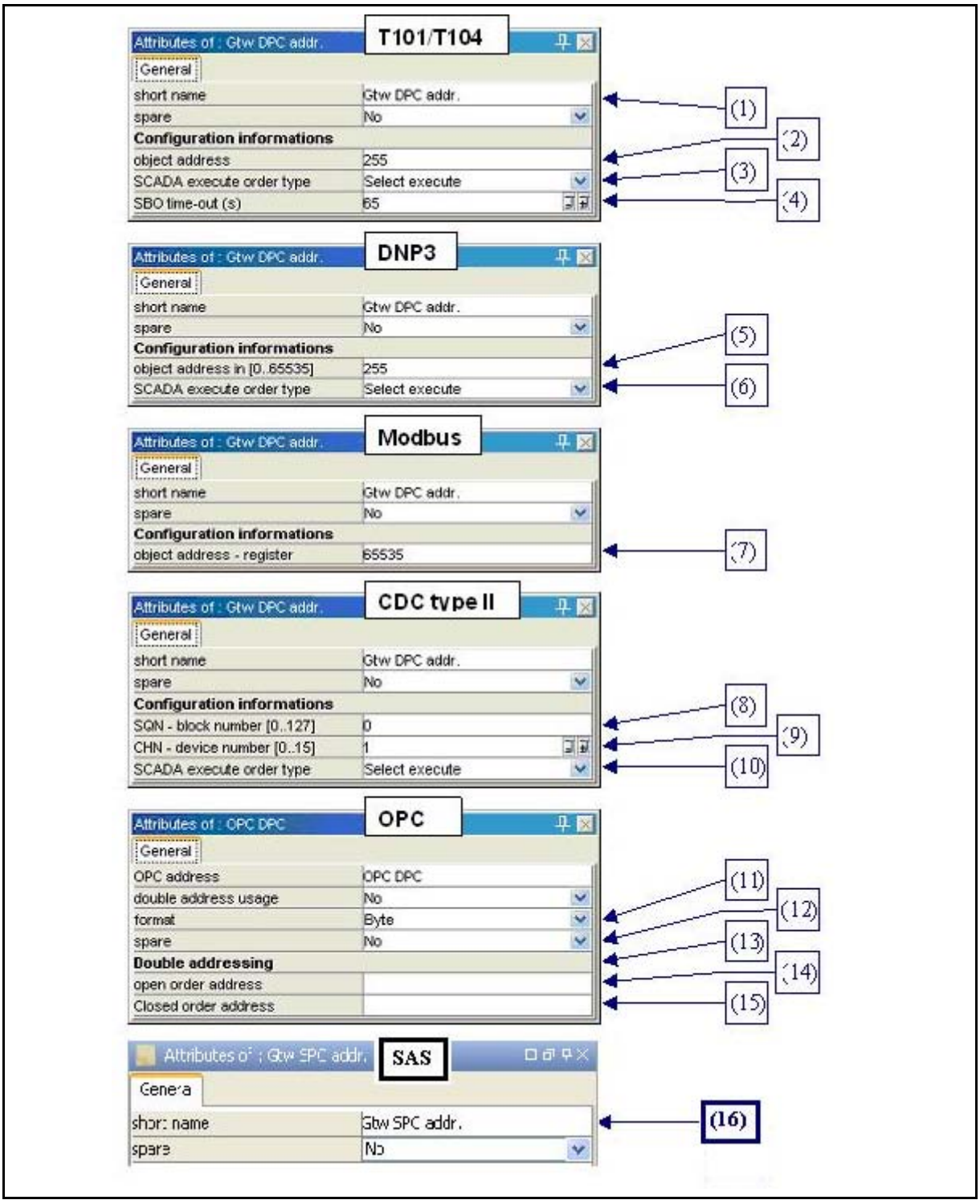


FIGURE 43: DEFINING A SCADA ADDRESS FOR A DPC DATAPOINT

4.4.2.7 Defining a SCADA address for a SetPoint datapoint

Addition of a SCADA address for a SetPoint datapoint is done under SCE via the “Object entry” area at SCADA SetPoint mapping level by clicking on mouse’s right button.

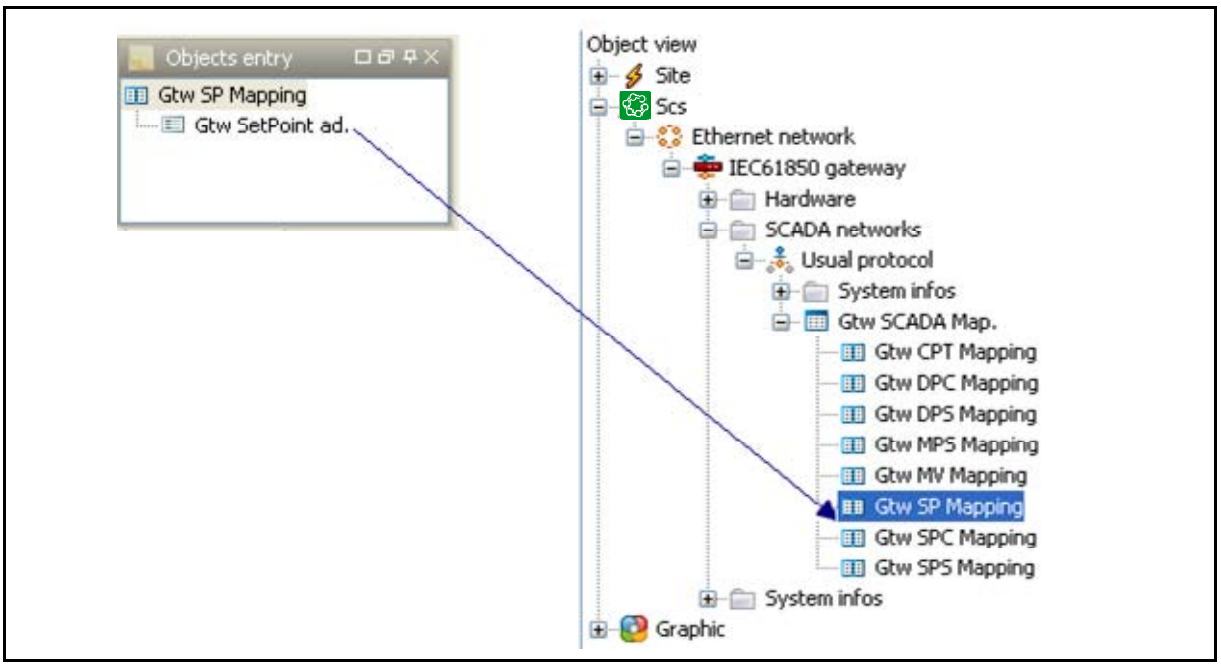


FIGURE 44: ADDING A SCADA SETPOINT ADDRESS

Once added, SCADA SetPoint address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **object address**
3. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.
4. **minimal value** (range [-2^{31},2^{31}-1],step 1): available minimal value on the protocol (used for scaling and checks)
5. **maximal value** (range [-2^{31},2^{31}-1],step 1): available maximal value on the protocol (used for scaling and checks)
6. **format** (Normalised / Adjusted / Float)
7. **SBO time-out** (range [0 s, 65535 s], step 1 s): time-out PACiS system has to acknowledge the selection.

For DNP3 protocol:

8. **object address [0..65535]**
9. **SCADA execute order type** (Select execute / Direct execute): this attribute defines which kind of sequence is used by the SCADA to send a control to the datapoint.

For CDC type II protocol:xxx

10. **SQN - block number [0..15]**
11. **CHN - device number [0..15]** (range [0,15], step 1 except 14)
12. **minimal value** (range [-2^{31},2^{31}-1],step 1): available minimal value on the protocol (used for scaling and checks)
13. **maximal value** (range [-2^{31},2^{31}-1],step 1): available maximal value on the protocol (used for scaling and checks)

For OPC protocol:

14. **OPC address**

For T101-SAS protocol:

The T101-SAS protocl does not support setpoints from SCADA to gateway.

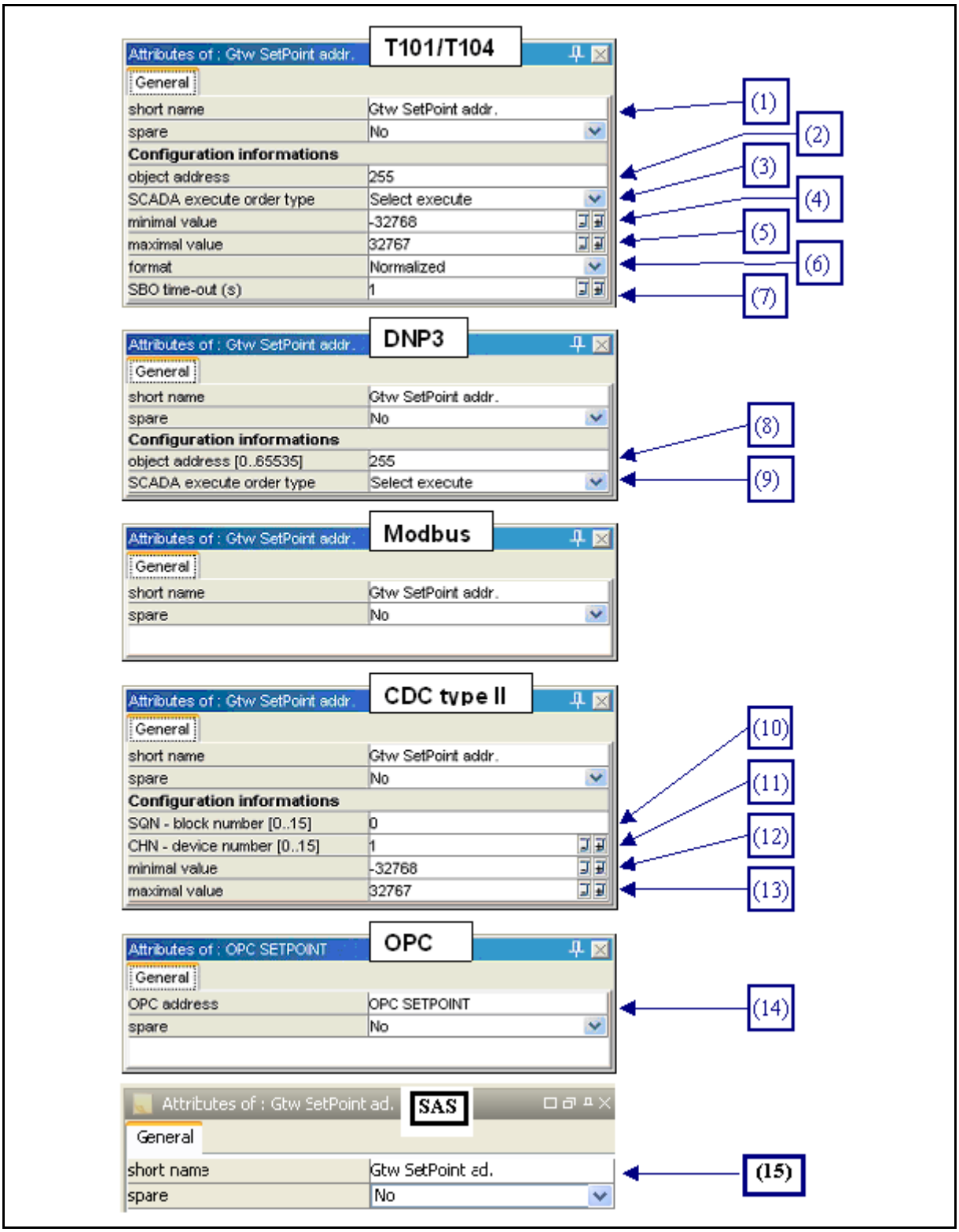


FIGURE 45: DEFINING A SCADA ADDRESS FOR A SETPOINT DATAPOINT

4.4.2.8 Defining a SCADA address for an MPS datapoint

Addition of a SCADA address for an MPS datapoint is done under SCE via the “Object entry” area at SCADA MPS mapping level by clicking on mouse’s right button.

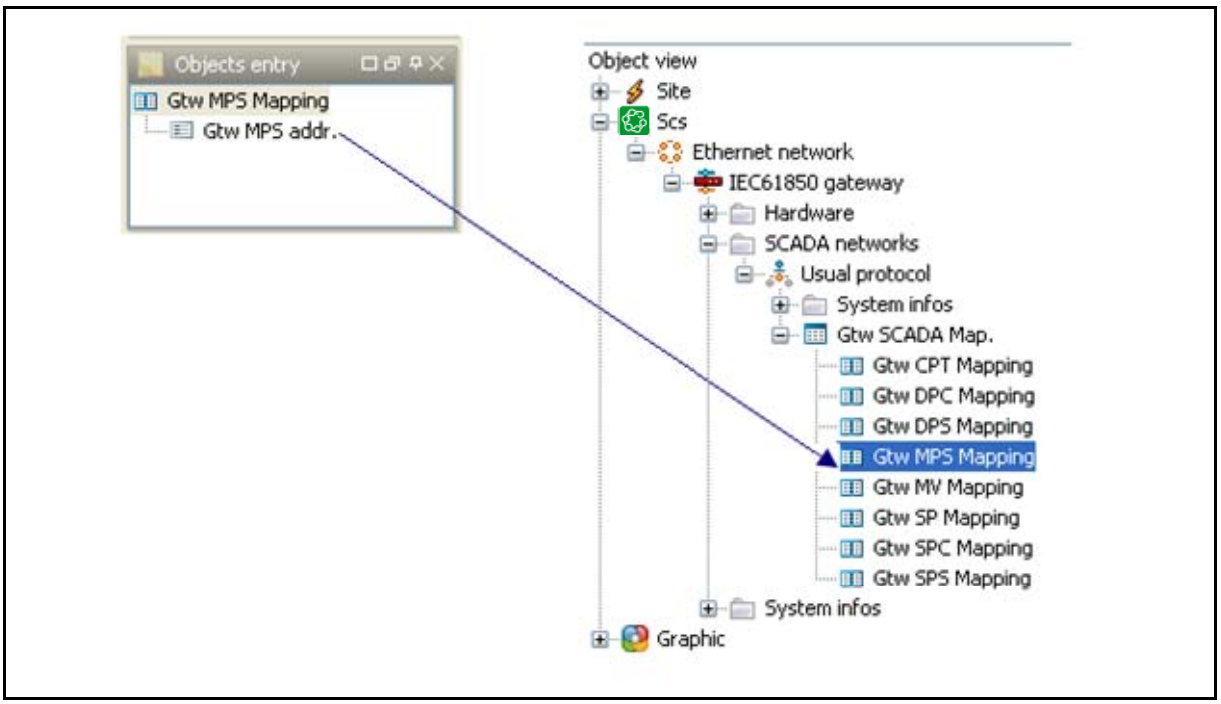


FIGURE 46: ADDING A SCADA MPS ADDRESS

Once added, SCADA MPS address attributes must be set at SCE level:

1. **short name** of the address used for internal SCE identification

For T101/T104 protocols:

2. **bitstring usage** (No / Yes): must be set to Yes. Indicates if the MPS is split or not.
3. **priority level** (from 1 to 255): gives the priority of emission (1: higher). Only significant if **Event** attribute is different from ‘No’. Is fixed to 1 for T104 protocol.
4. **Event** (No / Yes with time tag / Yes without time tag): when set to ‘Yes with time tag’ (resp. ‘Yes without time tag’), indicates if change of state of the datapoint are transmitted spontaneously with (resp. without) time tag
5. **Event record**: indicates if the datapoint will be recorded in the SOE file
6. **Background scan** (No/Yes): indicates if the datapoint belongs to the background scan cycle
7. **Group ([0..16)] / 0=no group)** (range [0,16], step 1) indicates to which “T101/T104 General Interrogation group” the datapoint is assigned. 0 means ‘no group’ assignation.
8. **multistate address**: not used, because the MPS is not split
9. **state_X address** (0 to 15 for X): indicates the T101/T104 address which will be set if the MPS takes the value X

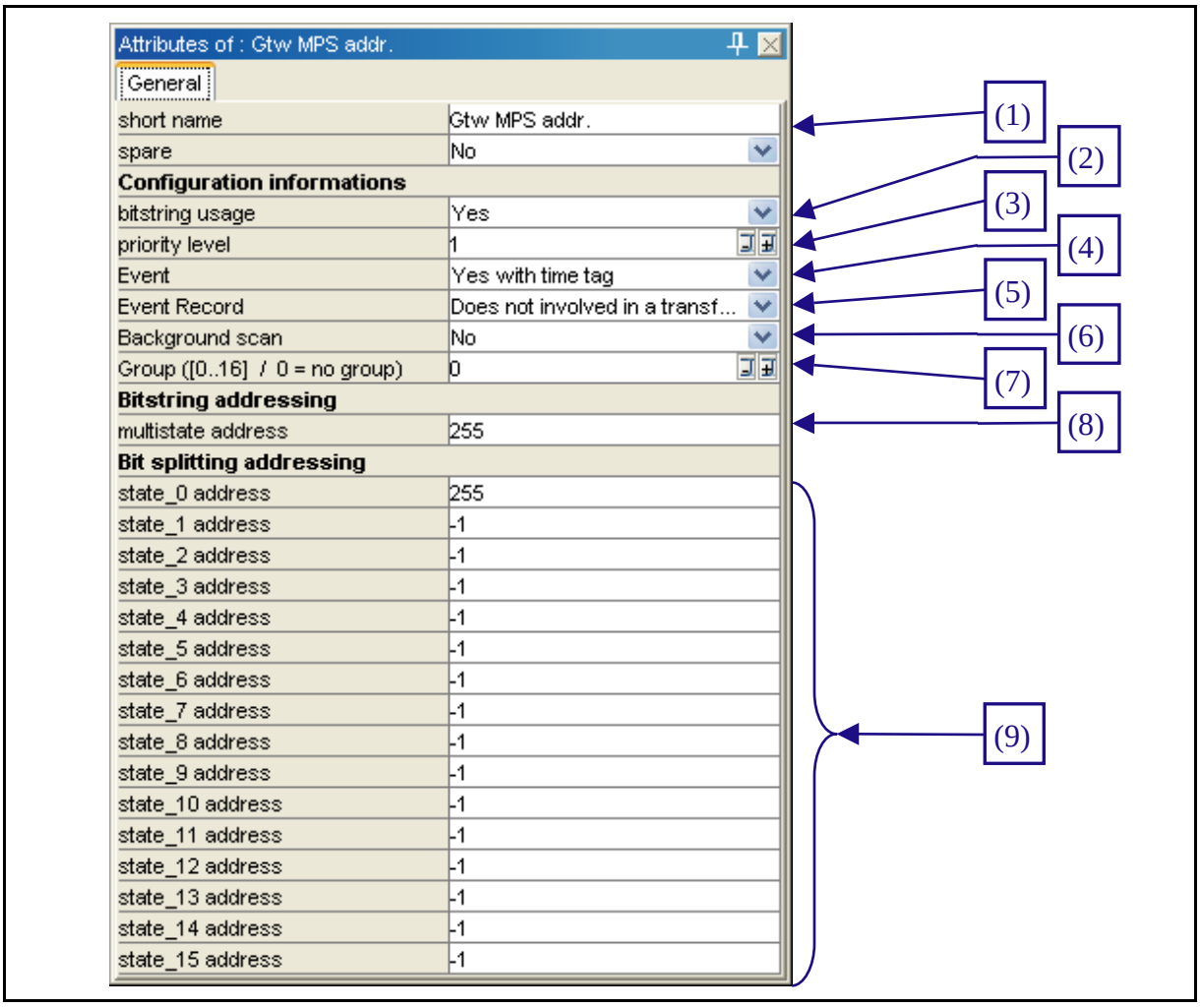


FIGURE 47: GENERAL ATTRIBUTES OF AN MPS ADDRESS FOR T101/T104 PROTOCOLS

For DNP3 protocol:

1. **bitstring usage** (No / Yes): must be set to Yes. Indicates if the MPS is split or not.
2. **Event** (No / Yes with time tag / Yes without time tag): when set to 'Yes with time tag' (resp. 'Yes without time tag'), indicates if change of state of the datapoint are transmitted spontaneously with (resp. without) time tag
3. **multistate address**: not used, because the MPS is not split
4. **state_X address** (0 to 15 for X): indicates the DNP3 address which will be set if the MPS takes the value X

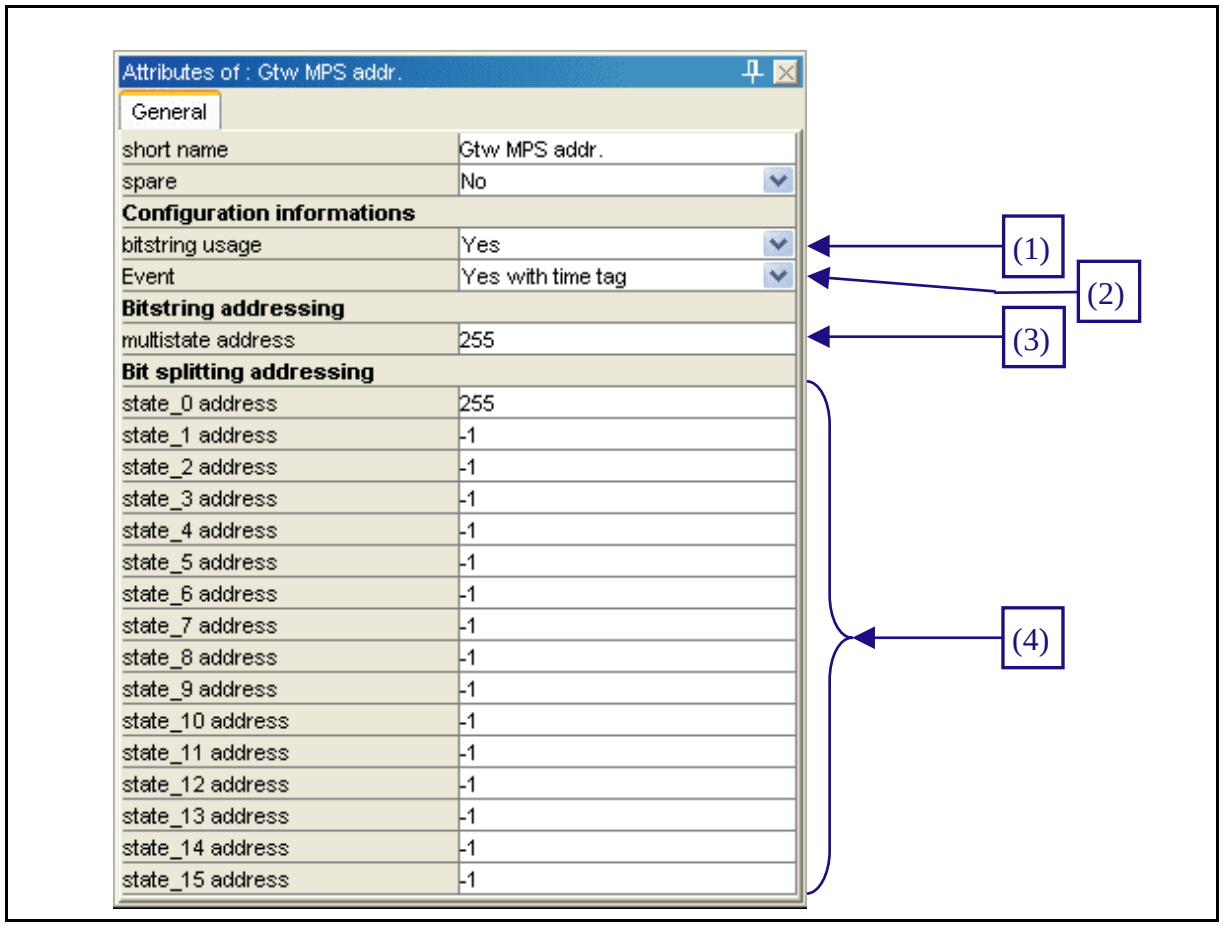


FIGURE 48: GENERAL ATTRIBUTES OF AN MPS ADDRESS FOR DNP3 PROTOCOL

For Modbus protocol:

1 **state_X register address** (0 to 15 for X): indicates the Modbus address which will be set if the MPS takes the value X

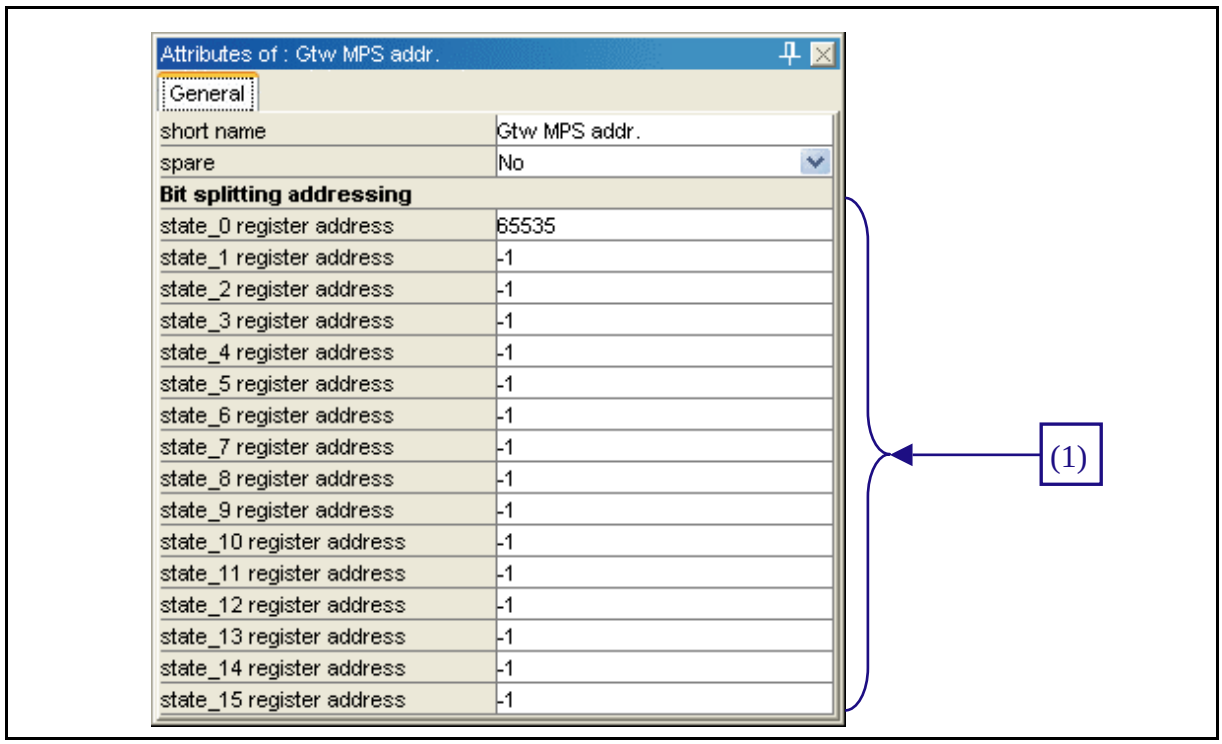


FIGURE 49: GENERAL ATTRIBUTES OF AN MPS ADDRESS FOR MODBUS PROTOCOL

For CDC type II protocol:

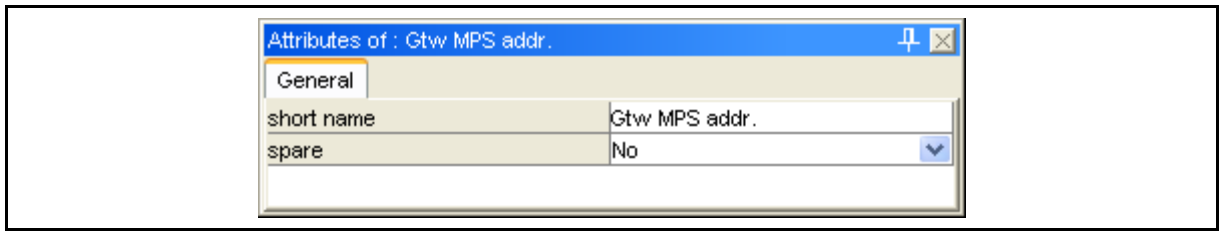


FIGURE 50: GENERAL ATTRIBUTES OF AN MPS ADDRESS FOR A CDC TYPE II PROTOCOL

For OPC protocol:

12. **OPC address**: indicates the name's tag for OPC (limited to 48 characters). The character "." indicates that the name is hierarchical.

13. **Historization** (No / Yes): indicates if this tag is sent at historic timer frequency

For MPS the format is set to VT_I2 (two-bytes integer)

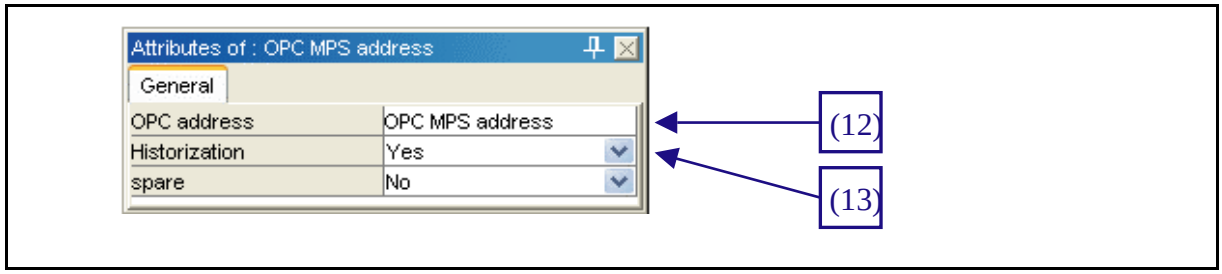


FIGURE 51: DEFINING GENERAL ATTRIBUTES OF MPS ADDRESS FOR OPC PROTOCOL

For T101-SAS protocol:

14. **short name** of the address used for internal SCE identification
15. **Send in GI** (No/Yes): indicates if the datapoint is included into the General Interrogation
16. multistate **address**: not used, because the MPS is not split
17. state_**X address** (0 to 15 for X): indicates the T101-SAS address which will be set if the MPS takes the value X

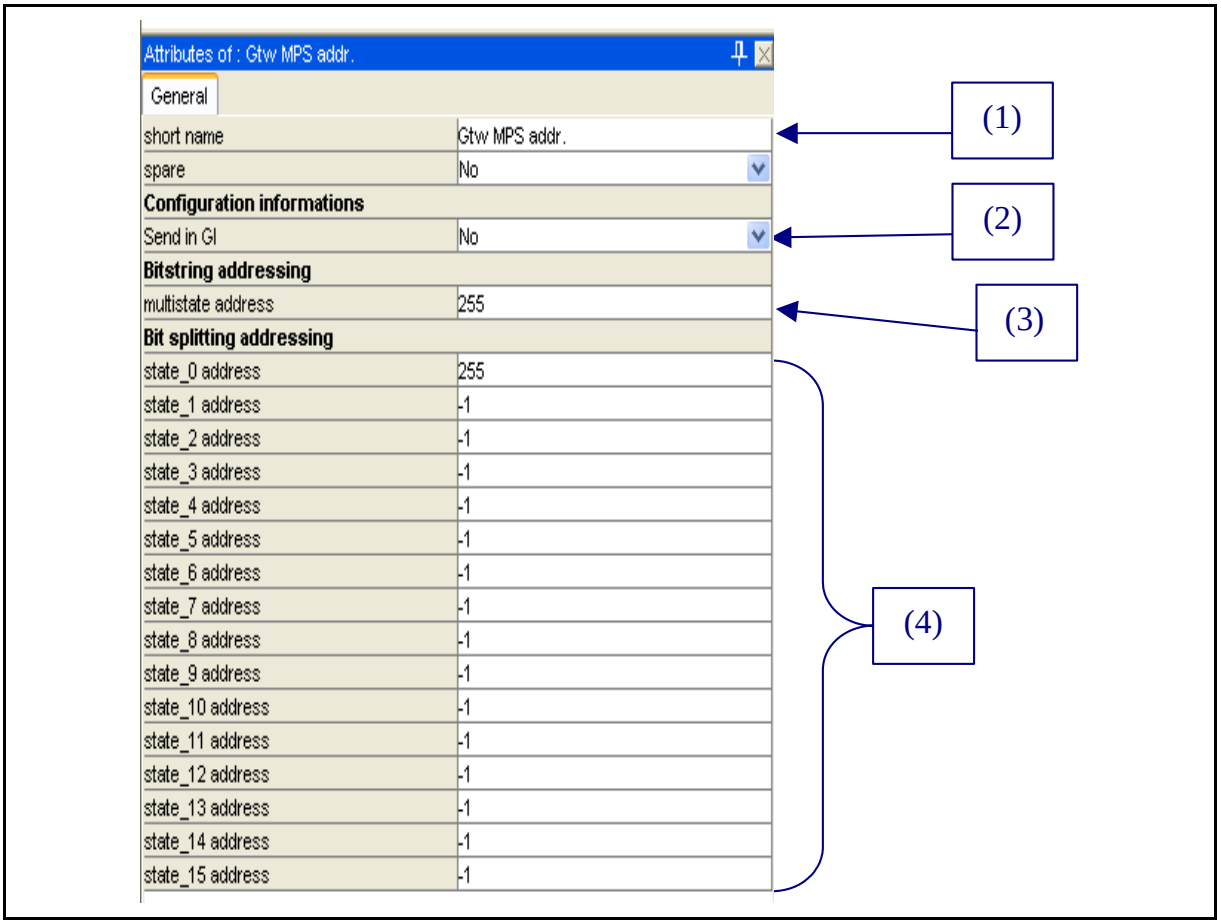


FIGURE 52: DEFINING GENERAL ATTRIBUTES OF MPS ADDRESS FOR T101-SAS PROTOCOL

4.4.2.9 Defining a SCADA address for bypass synchro-check

For details about synchronised circuit-breakers, refer to the C264/C264C application chapter (C264/EN AP).

Synchronised circuit-breaker can be controlled through SCADA network. In that case, the SPC (resp. DPC) control of the synchronised breaker is linked to a SCADA SPC (resp. DPC) address. Unfortunately, bypass synchro-check is not implemented in SCADA protocol. To solve this problem, an extra SCADA SPC (resp. DPC) address that will bypass the synchro-check, must be given to the SPC (resp. DPC) control of the breaker. At SCE level, this extra address is linked to the SCADA address of the SPC (resp. DPC) control of the synchronised breaker.

To define a SCADA address for bypass synchro-check:

- Create the SCADA SPC (resp. DPC) address (A) to send SPC (resp. DPC) control of the synchronised breaker
- Create a SCADA SPC (resp. DPC) address (B) for bypass synchro-check in the SCADA mapping,
- Add the relation 'has for bypass synchro-check address' via the "Object entry" area at SCADA address (A) and fill it with the SCADA address (B).

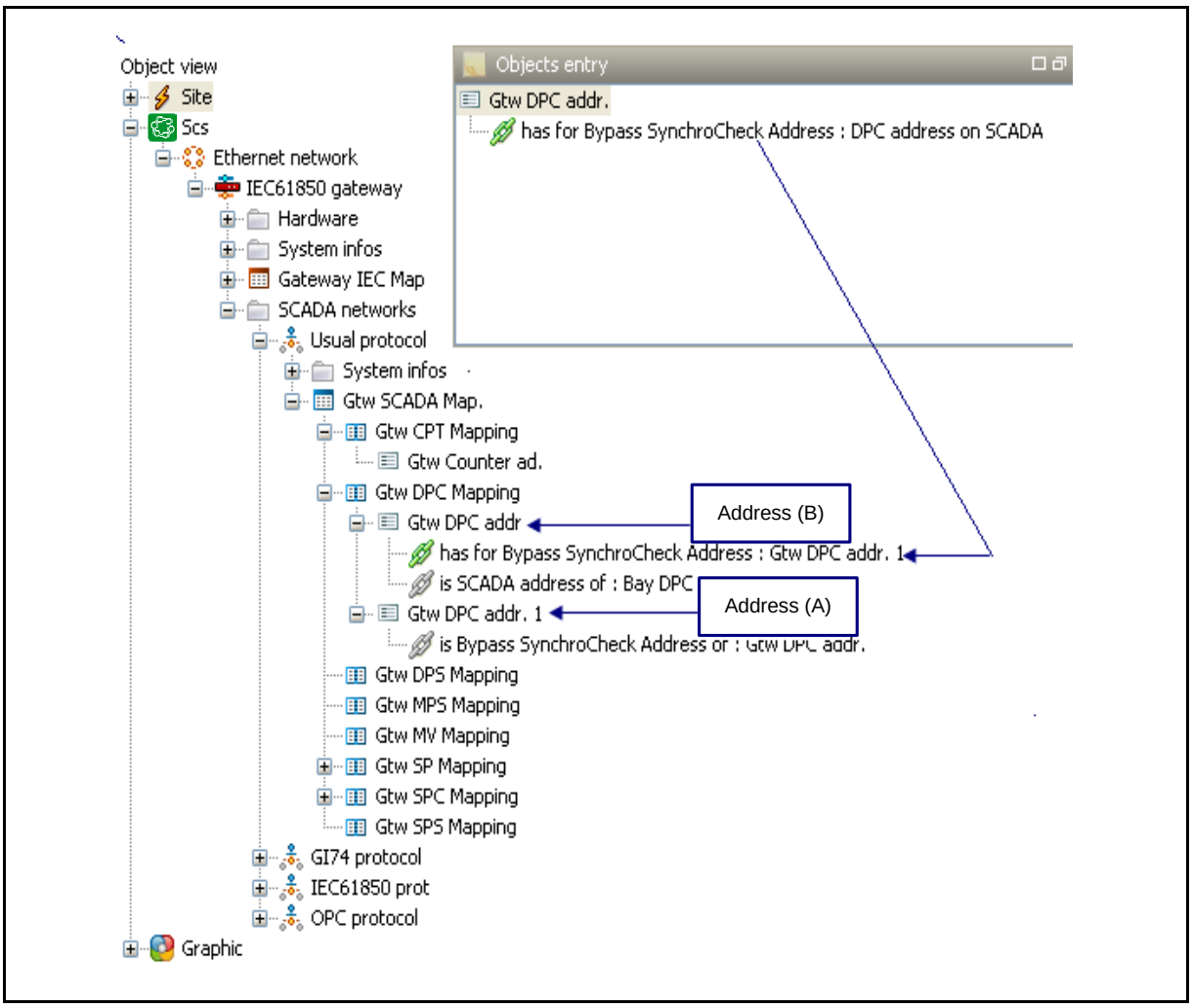


FIGURE 53: ADDING A BYPASS SYNCHRO-CHECK ADDRESS TO A SCADA SPC/DPC ADDRESS (E.G. FOR SCADA DPC ADDRESS)

4.4.3 Addressing datapoint on SCADA legacy network

To exchange datapoint values between station-bus sub-systems and SCADA, datapoints should be linked to specific SCADA addresses, by adding at datapoint level the relation 'has for SCADA address' (1) and filling it with the corresponding SCADA address in a pre-configured SCADA addressing mapping (refer to section 4.4.2 Defining addressing mapping of SCADA legacy network, for SCADA mapping definition).

Addressing MPS datapoint on SCADA legacy network is not available.

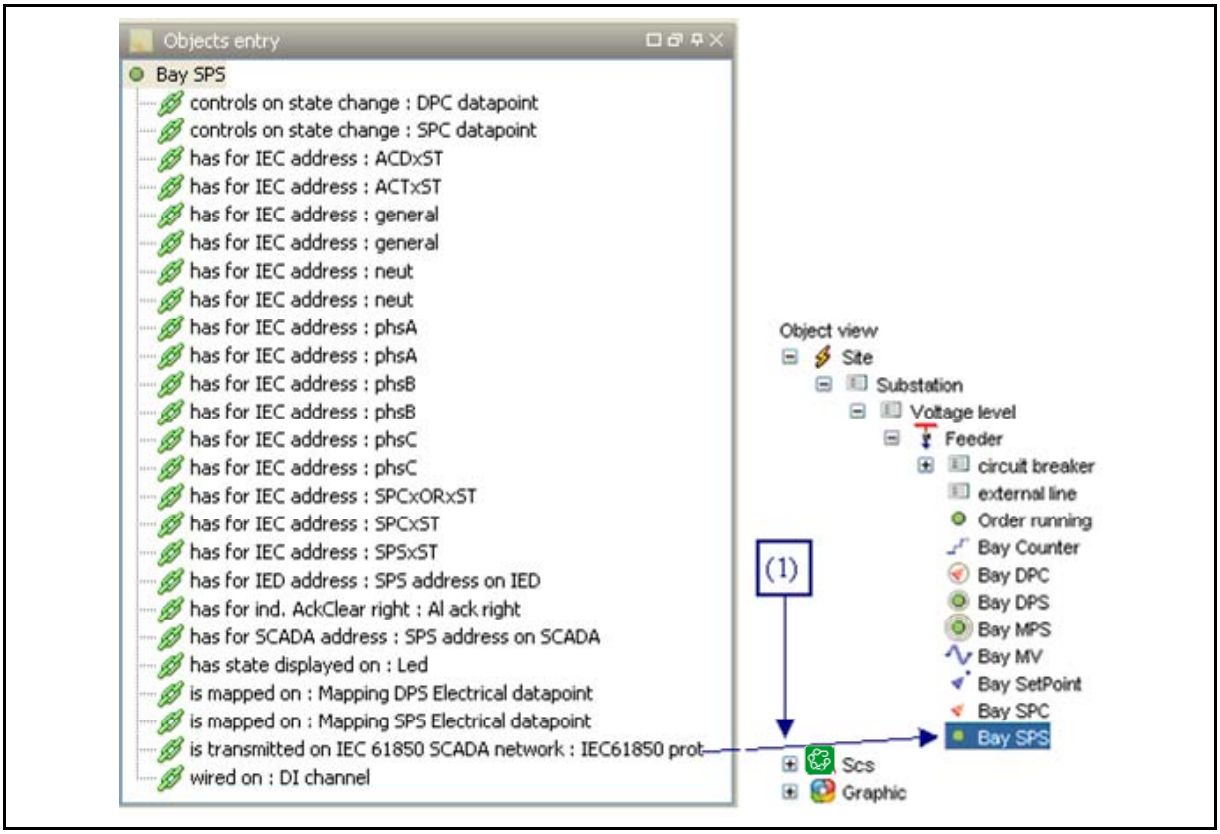

Objects entry
Bay SPS
controls on state change : DPC datapoint
controls on state change : SPC datapoint
has for IEC address : ACDxST
has for IEC address : ACTxST
has for IEC address : general
has for IEC address : general
has for IEC address : neut
has for IEC address : neut
has for IEC address : phsA
has for IEC address : phsA
has for IEC address : phsB
has for IEC address : phsB
has for IEC address : phsC
has for IEC address : phsC
has for IEC address : SPCxORxST
has for IEC address : SPCxST
has for IEC address : SPSxST
has for IED address : SPS address on IED
has for ind. AckClear right : Al ack right
has for SCADA address : SPS address on SCADA
has state displayed on : Led
is mapped on : Mapping DPS Electrical datapoint
is mapped on : Mapping SPS Electrical datapoint
is transmitted on IEC 61850 SCADA network : IEC61850 prot
wired on : DI channel
(1)
Object view
Site
Substation
Voltage level
Feeder
circuit breaker
external line
Order running
Bay Counter
Bay DPC
Bay DPS
Bay MPS
Bay MV
Bay SetPoint
Bay SPC
Bay SPS
Scs
Graphic

FIGURE 54: REALISING SCADA ADDRESSING OF A DATAPOINT
(E.G. FOR BAY SPS DATAPOINT)

4.5 Setting system information for GTW components

When creating a GTW, specific datapoints are automatically added in ‘system infos’ binder (1) at GTW level or PLC sub-component.

So it is when adding a SCADA network (2) attached to a GTW. In that case, the ‘system infos’ binder is located under the relevant added object.

SCE calls such ‘system infos’ datapoints, system datapoints.

System datapoints provide real-time statuses and controls on system software or hardware components.

As datapoint, system datapoints must be linked to a profile. For details about datapoint and datapoint profile configuration, refer to the C264/C264C application chapter (C264/EN AP). Depending on its kind, the system datapoint and its relevant profile have specific attributes to be set correctly to insure healthy behaviour of MiCOM C264 computer. Hereafter, are listed the datapoint and profile requirements for each kind of system datapoint.

Generally system datapoints are automatically addressed in IEC61850 mapping of the relevant MiCOM C264 computer at their creation. If manual addressing is necessary, it is stressed in following chapters by given the associated available data object of a given MiCOM C264 computer brick in LD0 (⇔<brick name>.<data object name>). For details about IEC61850 addressing see section 4.3 Networking GTW on the station-bus network.

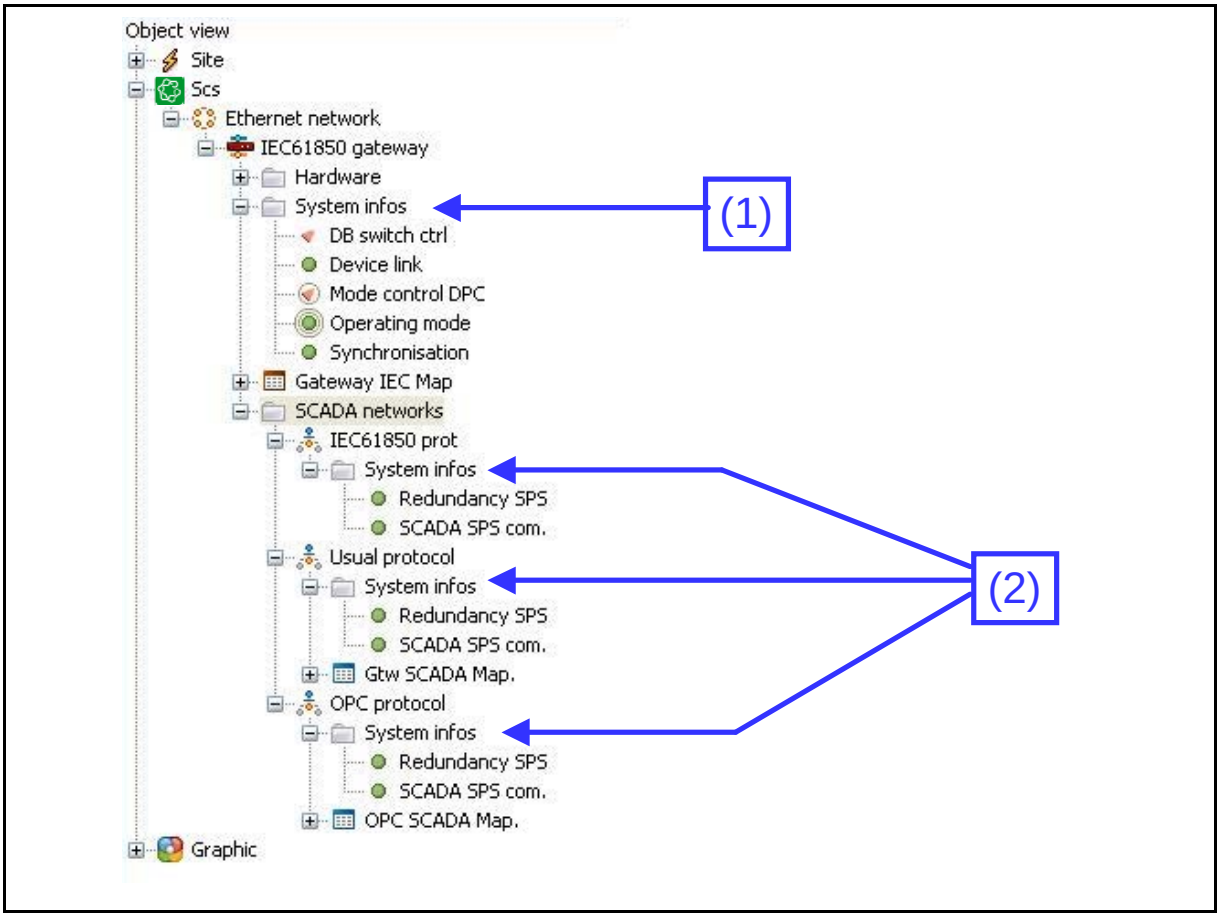


FIGURE 55: ‘SYSTEM INFOS’ BINDERS FOR A GTW

4.5.1 Setting general system information of GTW

When creating a GTW, the following mandatory datapoints are implicitly added.

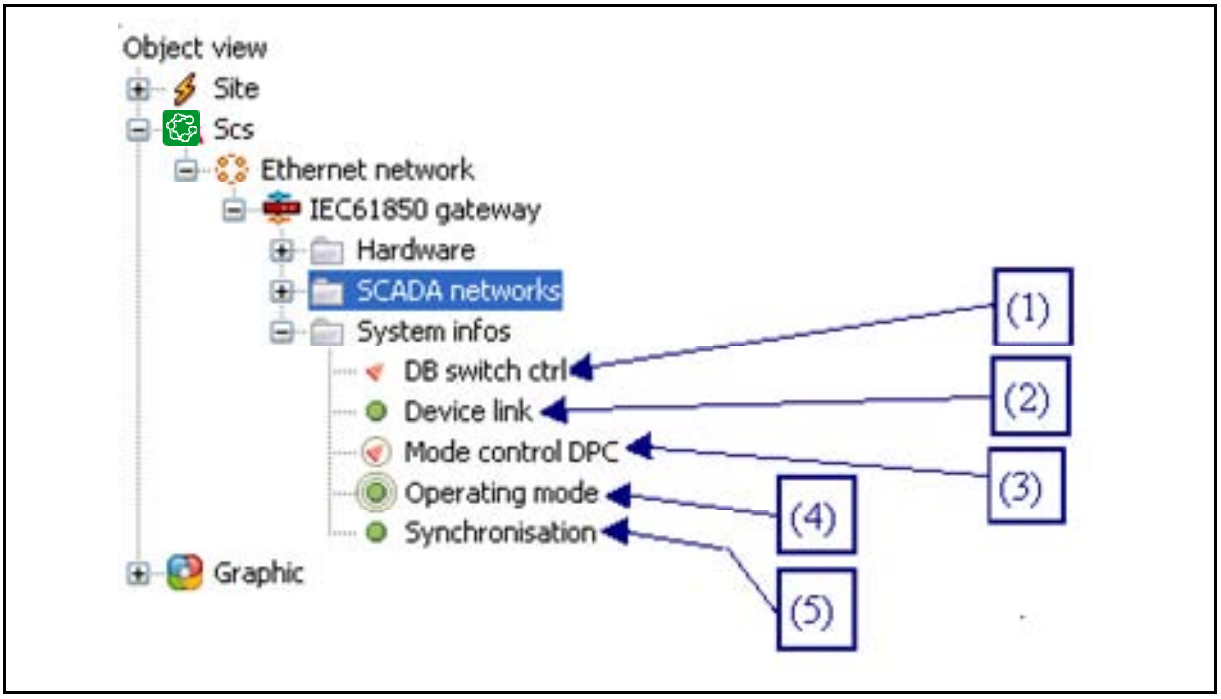


FIGURE 56: MANDATORY 'SYSTEM INFOS' DATAPOINTS FOR A GTW

These datapoints must be configured according to their described features:

- Controls and statuses for functioning mode

  – **Mode control DPC** (3): only used by the SMT to turn device functioning mode to Maintenance or Operational/Run

IEC61850 addressing	**Available states**	
⇔ LLN0.Mod Automatic at datapoint creation	• 1 • 2 • 3,4 • 5 • 0	Operational/Run Blocked Test,Test/Blocked Maintenance Faulty

  – **Operating mode MPS** (4): the available states of this datapoint are:

    – "STATE 0" for the Faulty mode

    – "STATE 1" for Operational mode

    – "STATE 3" for Test mode

    – "STATE 5" for Maintenance mode

  An IEC address for this datapoint is defined by using SBUS automatic addressing.

- Control and status for database management

  – **DB switch ctrl SPC** (1): only used by the SMT to turn device functioning mode to Maintenance or Operational/Run

IEC61850 addressing	Available states
⇔ DBID.ODDBSw Automatic at datapoint creation	• ‘ON’: Switch

- Synchronisation status

  – **Synchronisation SPS** (5): fixed to ‘SET’ state if device is synchronised.

IEC61850 addressing	Available states
⇔ C26xDIAG.SyncSt Automatic at datapoint creation	• ‘RESET’: Not synchronised • ‘SET’: Synchronised

- Communication status

  – **Device link SPS** (2): although this datapoint is under the MiCOM C264 computer, it is not managed by it. Each IEC61850 client of the MiCOM C264 computer computes locally this datapoint status by supervising the IEC61850 real-time link with the MiCOM C264 computer. In fact, there are as many ‘Device link SPS’ per MiCOM C264 computer basis as IEC61850 clients connected to the MiCOM C264 computer.
  Fix to ‘SET’ state if device link is operational.

4.5.2 Setting system information of SCADA network

When creating a SCADA network, the following mandatory datapoints are implicitly added.

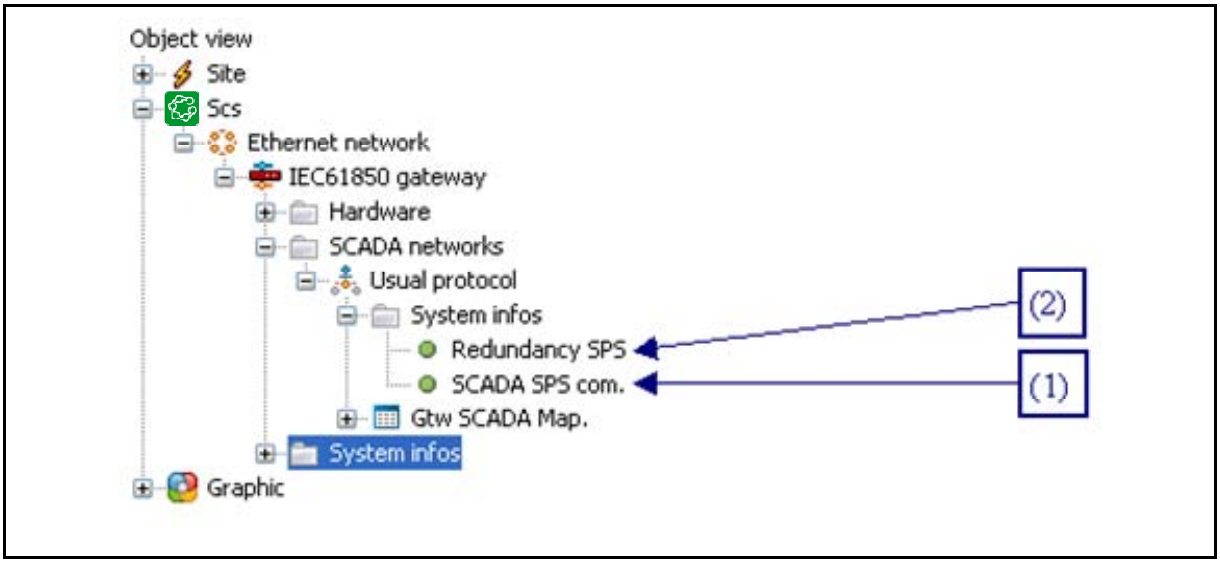


FIGURE 57: MANDATORY ‘SYSTEM INFOS’ DATAPOINT FOR SCADA NETWORK

These datapoints must be configured according to their described features:

- **SCADA communication status SPS** (1): fixed to 'SET' state if communication with the SCADA is operational.

IEC61850 addressing	Available states
⇔ TGDIAG.CommSt<i> where <i> corresponds to the SCADA number (from 0 to 3). • Manually addressed in IEC61850 DIAG brick of the MiCOM C264 computer. Or • IEC61850 Automatic addressing usage.	• 'RESET': Communication not OK • 'SET': Communication OK

- **SCADA redundancy status SPS** (2): fixed to 'SET' state if redundancy with the SCADA is active.

IEC61850 addressing	Available states
⇔ TGDIAG.RedSt<i> where <i> corresponds to the SCADA number (from 0 to 3). • Manually addressed in IEC61850 DIAG brick of the MiCOM C264 computer. Or • IEC61850 Automatic addressing usage.	• 'RESET': StandBy • 'SET': Active

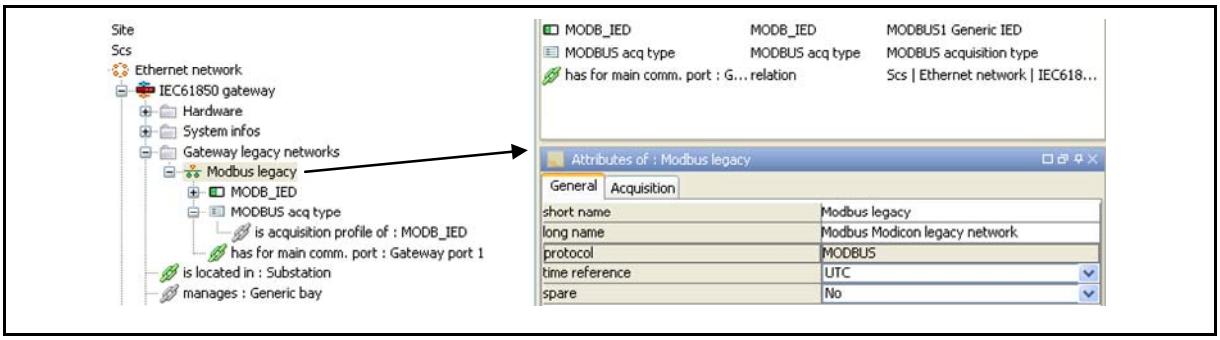
4.6 Gateway legacy networks

The procedure is the same as creating a C264 legacy network.

4.6.1 Creating a Gateway legacy networks

To create a Gateway legacy networks on a GTW:

- Add a network ("**Modbus legacy**" in example) from object entry available at **Gateway legacy networks** level.
- Update the network attributes relevant to its protocol characteristics (see following sections).
- Update its **has for main comm. port** relation and the communication port characteristics (see section 4.2.2 Configuring a communication channel).



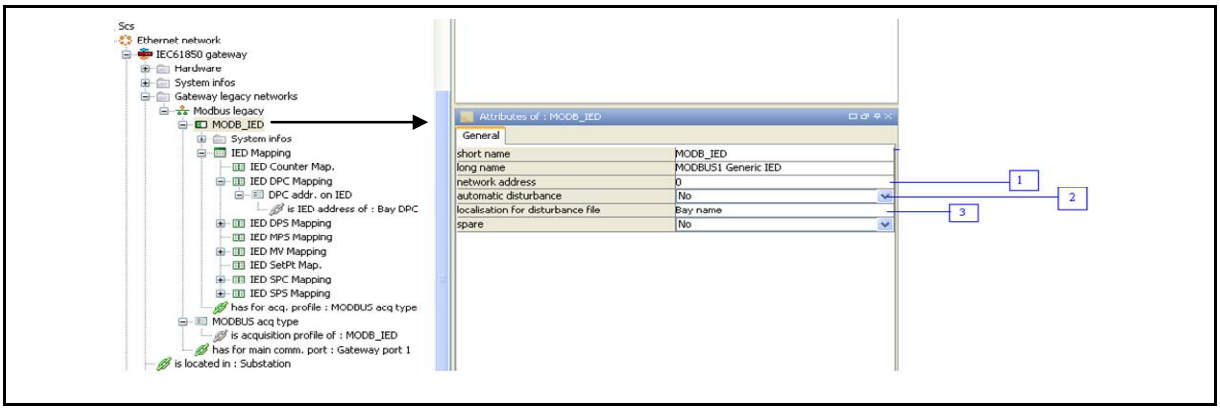
Time reference (UTC/local) defines which time reference is used to stamp events transmitted to GTW.

4.6.2 Setting specific attributes of a MODBUS IED network

Additional attribute in **General** tab-pane:

- Add the objects **MODB_IED** and **MODBUS acq type**; this adds the relation **is acquisition profile of** to **MODBUS acq type**.
- Link the **MODB_IED** with the brick **MODB_IED**.
- To create a redundant link: Add **has for aux. comm. port** extra relation and type the related port.
- Update the attributes of **MODB_IED** as shown

The attributes of input Datapoint Address on IED are defined as shown in the screenshot:



"**short name**" and "**long name**": used for logs, alarms, …

1. network **address**: (32 characters at most)
2. automatic **disturbance**: (yes/no)
3. localisation **for disturbance file**: Bay Name

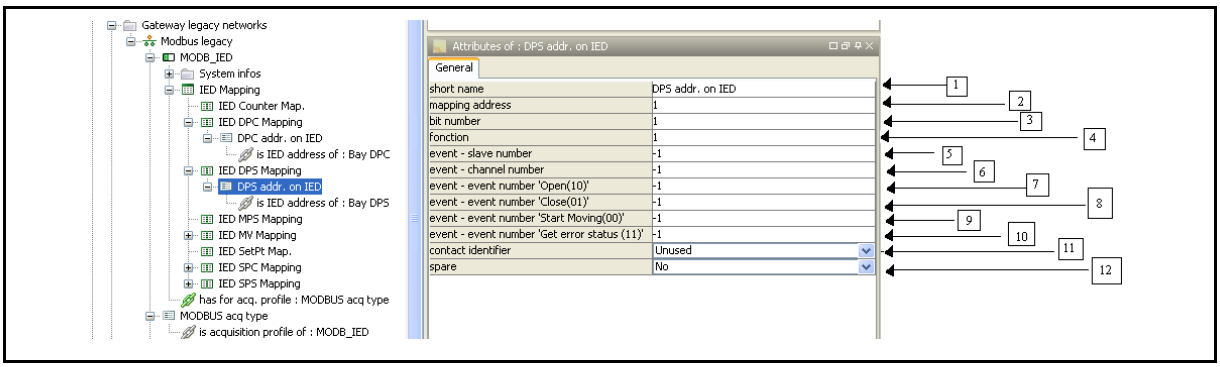
Develop the **MODB_IED** (icon +) and set the relation "**has for acqu. profile**" to the brick **MODBUS acquisition type**.

Add an **IED Address of** relation on each IED datapoint mapping defined under **MODB_IED** and associate it to the IED datapoint defined in the bay in substation.

For example:

DPS acquisition on IED:

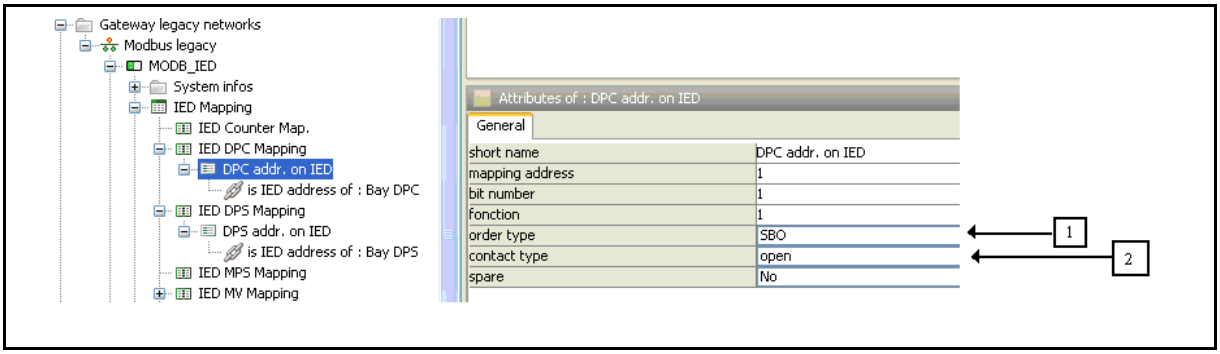
Create one or two **DPS addr. on IED**:



– 1 stands for No used.

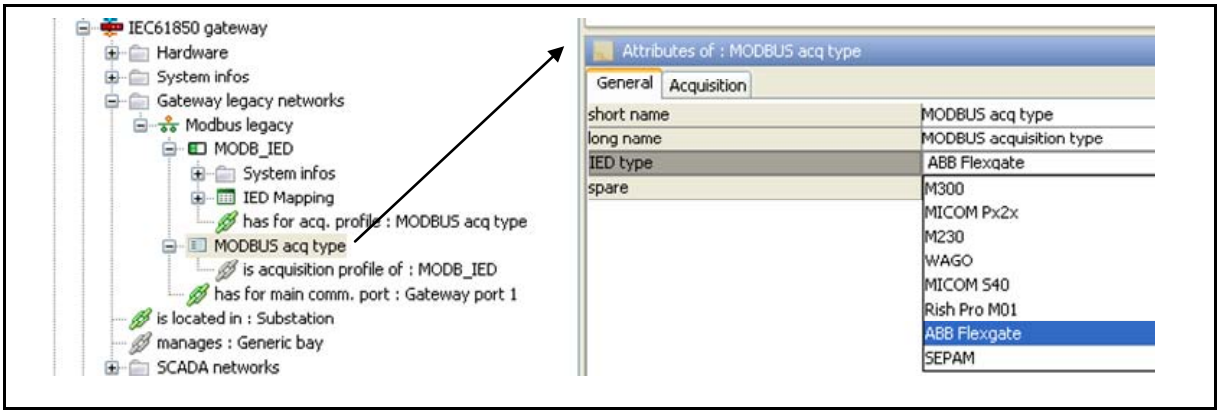
1. **short name**: short name of the datapoint mapping (for internal identification)
2. mapping **address**: DI/AI address of IED (word or bit address depending on the #4)
3. **bit number** (range [0, 65535], step 1): for function Read 1 word or Read status
4. function: MODBUS function to use (1-2-3-4 for DIs, 3-4 for AIs, 7 for status byte)
5. **event**-slave **number**: event – slave number' corresponding to equipment number on sub-network
6. **event**-channel **number**: event – channel number' corresponding to the channel communication number with equipment number on sub-network
7. **event-event** number **'open(10)'**: number to indicate an Open State
8. event-**event number 'close(01)'**: to indicate a Close State
9. **event**-event **number 'Start Moving(00)'**: event number 'Start Moving (00)' corresponding to the event number to indicate a transient state
10. **event-event** number '**Get error status(11)**': event number 'Get error status (11)' corresponding to the event number to indicate an error state
11. **contact identifier**: 'Open' or 'Closed' to precise which state of the DPS is concerned by the IED address. If the DPS status is given by only one IED address, set it to Unused
12. **spare**: (yes/no)

Attributes of commands / setpoint address mapping on IED:



1. order **type**: Order type of command / setpoint (SBO, Direct Execute)
2. contact **type**: precise which order of the DPC is concerned by the IED address: open or close (unused if the control uses only one IED address)

Modbus acq type defines the type of IED the gateway has to connect in legacy. SCE allows configuration of different IED's as shown in the screenshot.

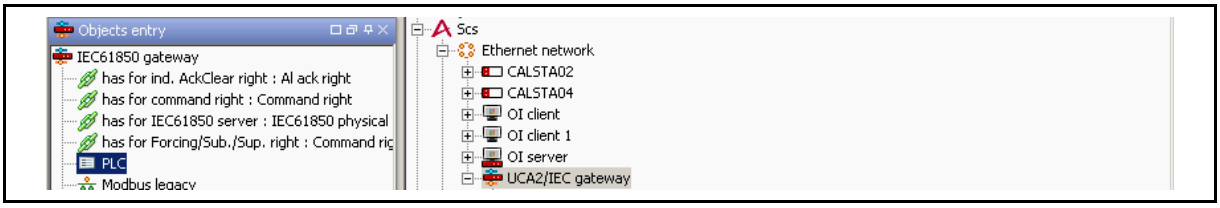


Acquisition tab:

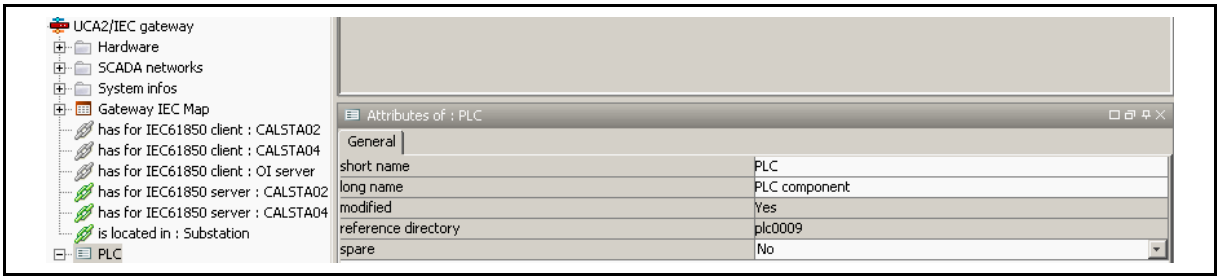
1. **number of retries** (range [1, 10], step 1): corresponds to the number of tries of the same frame without IED response, the computer will send it before setting it disconnected.
2. acknowledgement **time-out** (range [100 ms, 30 s], step 100 ms): maximum delay an IED answer is awaited when the computer asks it an information.
3. synchronisation (none / MiCOM / Flexgate): refer to the **CT chapter**
4. synchronisation **cycle** (range [10 s, 655350 s], step 10 s): time synchronisation period of the IED by the computer. Only significant if attribute (3) is set to 'MiCOM', 'Flexgate' . To keep the Px4x synchronised, C264 must send the frame at least every 5minutes; therefore the value must be lesser than 30 in this case.
5. downgraded **cycle** (range [1 s, 10 s], step 100 ms): if an IED is set disconnected by the computer, it tries to re-connect it regularly at this cycle.
6. **inter frame** duration (range [1, 50], step 1): minimum time, expressed in number of characters, that must exist between two frames.

4.7 Defining a PLC

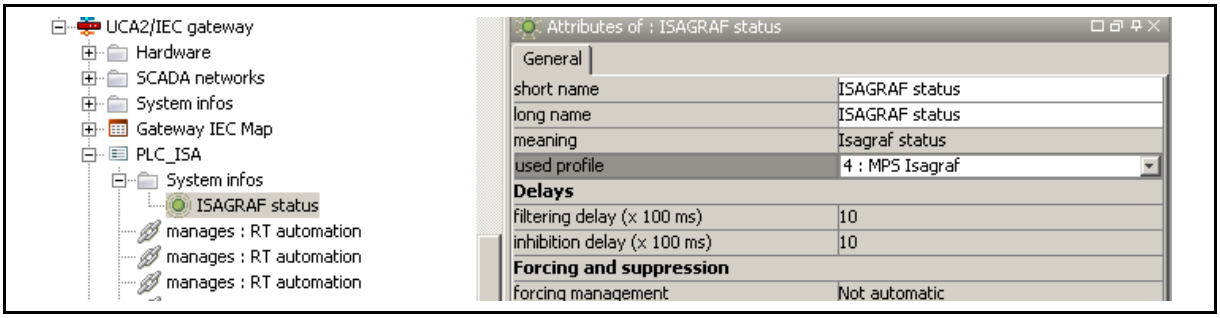
In the System architecture, under the GTW, tap into **Objects entry** window: right click the **PLC** brick and select **Add/double click the mouse on PLC**.



Set the **PLC** brick attributes:



From **PLC** brick, set the **ISaGRAF status attributes** (used profile =**4**: **MPS Isagraf**):



Attributes:

- **meaning**: datapoint meaning (read only)
- **used profile**: Integer [0..65535]
- **filtering delay**: if lack of inhibiting signal (x 100 ms); default value:10 (read only)
- **inhibition delay** (x 100 ms); default value:10 10 (read only)
- **forcing management** (read only)

NOTE: From PLC brick, **manages: RT automation** link(s) is/are displayed when an IsaGraf RT automation is defined, see section AP Defining an ISaGRAF RT automation, in this chapter AP.

5. DEFINING PACIS GATEWAY CONFIGURATION IN ELECTRICAL ARCHITECTURE

GTW configuration is concerned by the electrical architecture definition for the 3 following functionality:

- Defining Substation and Bay Local/remote dependencies
- Defining SBMC dependency
- Defining Taking control for substation and SCADA links
- Defining an ISaGRAF RT automation

For other details about the definition of electrical topology, refer to the C264/C264C application chapter (C264/EN AP).

5.1 Defining Substation and Bay Local/Remote dependencies

5.1.1 Introduction

Local/remote for substation

A substation can be in remote or local control mode.

The Remote mode indicates that the substation is controlled from Remote Control Point (RCP), via GTW. No controls can be sent from Substation Control Point level, except if the concerned bay is in SBMC mode (refer to section 5.2 Setting SBMC dependency attribute of control datapoint).

The Local mode indicates that the substation is controlled from PACiS Operator Interface (Substation Control Point). The controls issued from RCP are not taken into account by the system, they are refused.

Some controls, defined during the configuration phase, can be independent of the substation control mode: it means they can be issued from SCP or RCP whatever the current control mode is. For details about the configuration of this dependency attribute, refer to the following sub-sections.

For details about definition of Local/remote for substation, refer to the C264/C264C application chapter (C264/EN AP).

Local/remote for bay

More, each bay can be independently in Remote or Local mode.

The Remote mode indicates that the bay is controlled from the upper level, i.e. Remote Control Point (RCP) or Substation Control Point (SCP) depending on the current substation control mode. No controls can be sent from Bay Control Point (BCP) level, i.e. operator interface at the MiCOM C264 computer that manages the bay.

The Local mode indicates that the bay is controlled from BCP. The controls issued from upper level are not taken into account by the bay.

Some controls, defined during the configuration phase, can be independent of the bay control mode: it means they can be issued from any control points whatever was the current control mode. For details about the configuration of this dependency attribute, refer to the following sub-sections.

In Local or Remote mode, the information issued from the bay is always sent to SCP and RCP.

To configure Local/remote bay refer to the C264/C264C application chapter (C264/EN AP).

5.1.2 Setting 'Local/remote dependencies' attributes of control datapoint

Control datapoints are SPC, DPC, and SetPoint.

Local/remote dependencies for control whose level is less or equal to bay

1. Bay mode dependency (No / Yes)
2. Bay control uniqueness dependency (No / Yes)
3. Local Substation dependency : (Command from SCADA is accepted / Command from SCADA is refused).
4. Remote substation dependency: (Command from OI is accepted / Command from OI is refused).

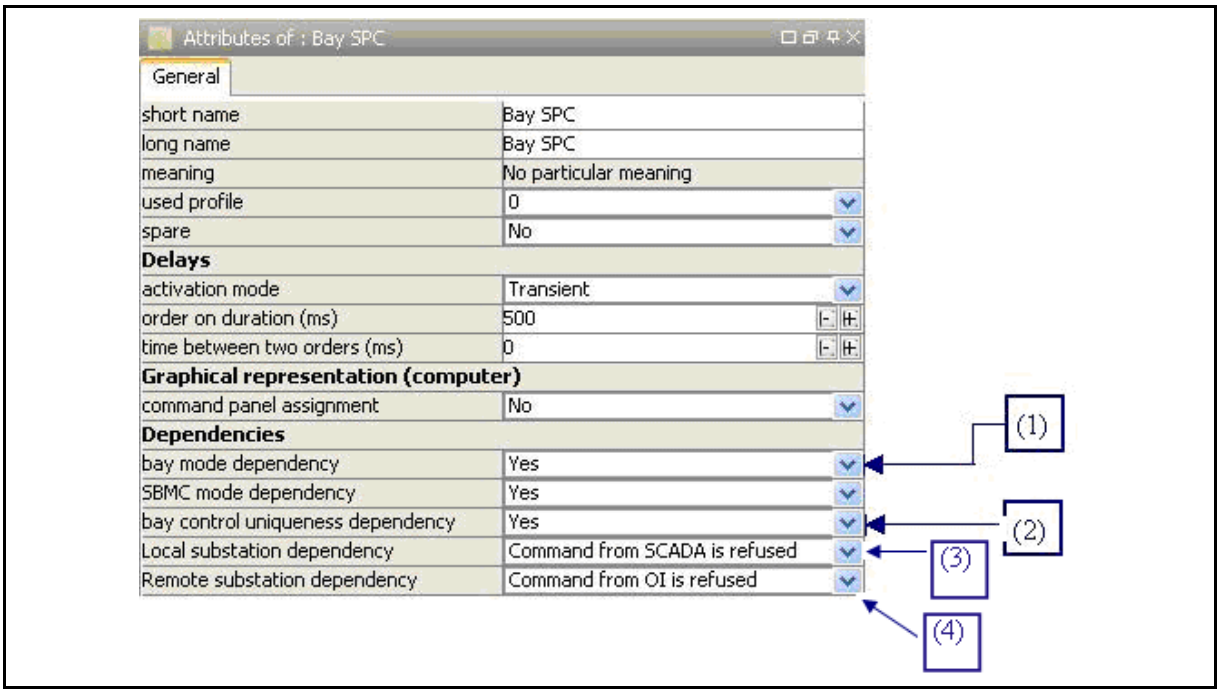


FIGURE 58: SETTING LOCAL/REMOTE DEPENDENCIES ATTRIBUTES TO CONTROL DATAPOINT (SAMPLE GIVEN AT BAY LEVEL FOR GENERIC SPC)

Local/remote dependencies for control whose level is higher to bay

5. Substation control uniqueness dependency (No / Yes)

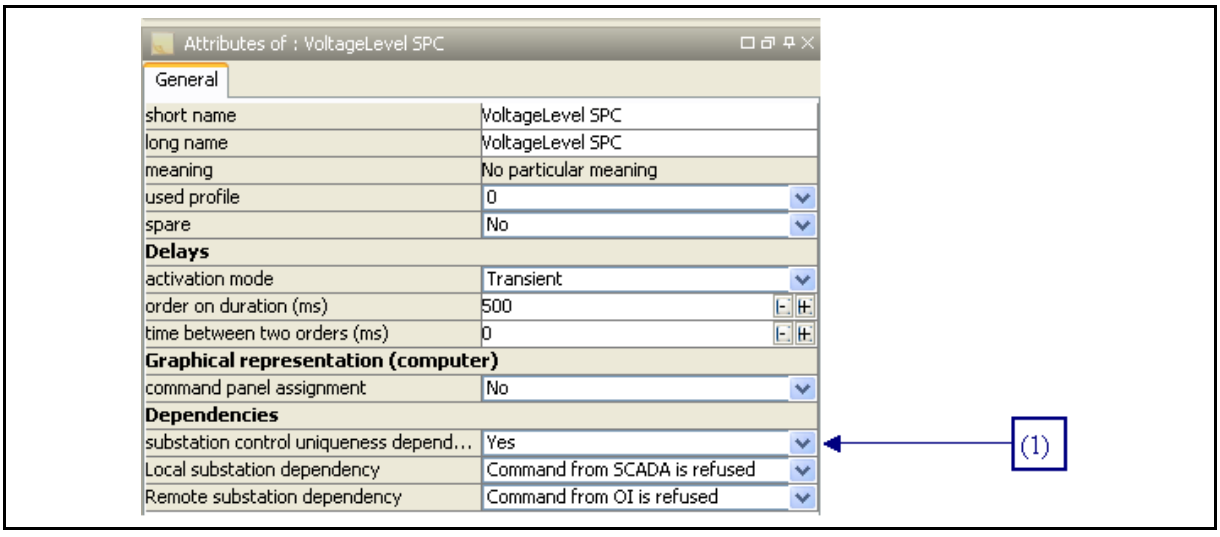


FIGURE 59: SETTING LOCAL/REMOTE DEPENDENCIES ATTRIBUTES TO SPC DATAPOINT (SAMPLE GIVEN AT VOLTAGE LEVEL FOR GENERIC SPC)

5.2 Setting SBMC dependency attribute of control datapoint

5.2.1 Introduction

Each bay can be set in SBMC mode (Site Based Maintenance Control mode).

In SBMC mode a bay does not take into account the commands issued from Remote Control Point (RCP), even if the substation is in remote. Some controls, defined during the configuration phase, can be independent of the SBMC mode. For details about the configuration of this dependency attribute, refer to section 5.2.2 Setting 'SBMC dependency' attribute of control point.

This function provides a facility to control selected bays from the Substation Control Point (SCP) and optionally to suppress or force to a pre-defined state, datapoint for the RCP while the substation is in Remote mode. If configured as SBMC dependant at its profile level, a datapoint belonging to a bay in SBMC mode takes the state defined in the profile configuration for the RCP, but is still processed normally in the Scs (e.g. all processes inside the system are unaffected by the state modification of an information at the RCP interface).

The states of datapoints sent to RCP are defined in their profile configuration. For each type of datapoint, they are:

SPS	SUPPRESSED, SET, RESET
DPS	SUPPRESSED, OPEN, CLOSE, JAMMED
MPS	SUPPRESSED, UNDEFINED
MV, TPI and Counter	SUPPRESSED

For details about SBMC configuration at datapoint profile level and to activate SBMC facilities at bay level, refer to the C264/C264C application chapter (C264/EN AP).

5.2.2 Setting 'SBMC dependency' attribute of control point

Control datapoints are SPC, DPC, and SetPoint.

SBMC dependencies for control whose level is less or equal to bay

SBMC mode dependency (No / Yes)

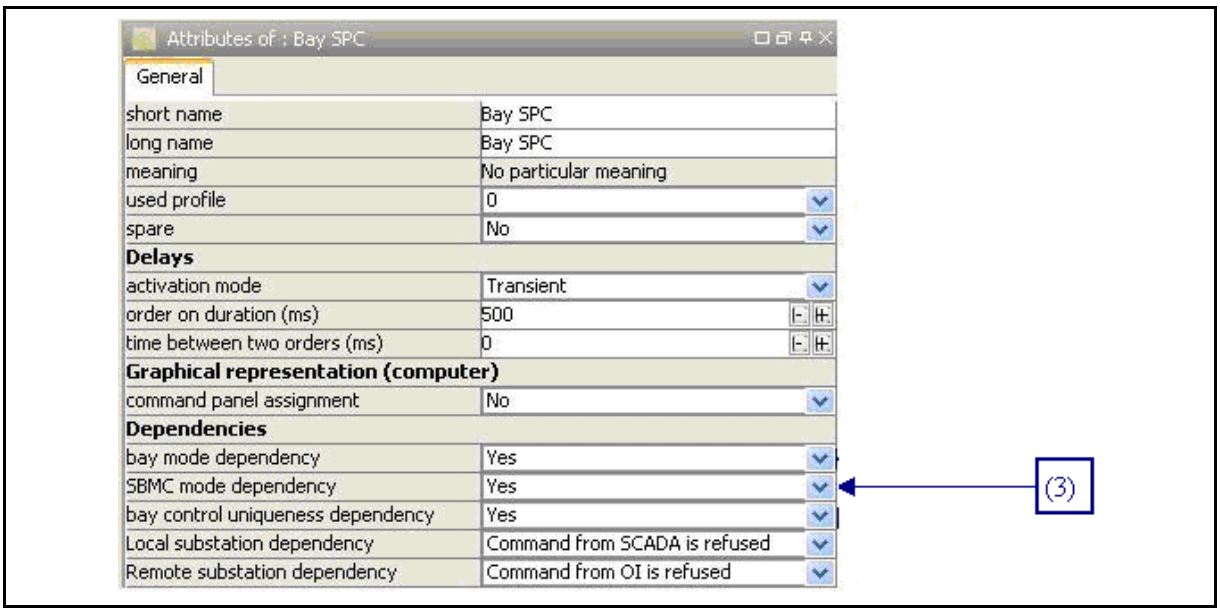


FIGURE 60: SETTING SBMC DEPENDENCY ATTRIBUTES TO CONTROL DATAPOINT (SAMPLE GIVEN AT BAY LEVEL FOR GENERIC SPC)

5.3 Defining Taking Control for substation and SCADA links

This facility allows a Remote Control Point (RCP) to force the mode of the substation from LOCAL to REMOTE and to define on which link the SCADA controls must be accepted.

So, Local/remote for substation must be defined before any Taking control configuration.

To activate Taking control facilities for a given SCADA network:

- add the optional datapoints 'Taking Control' (2) and 'Taking status' (1), via the "Object entry" area at substation level by clicking on mouse's right button
- configure them,
- add the relation 'is taken control of' at 'Taking status' datapoint level (3), and fill it with the relevant given SCADA network.
- do not forget to link via 'has for feedback' relation, the control with the status datapoint.

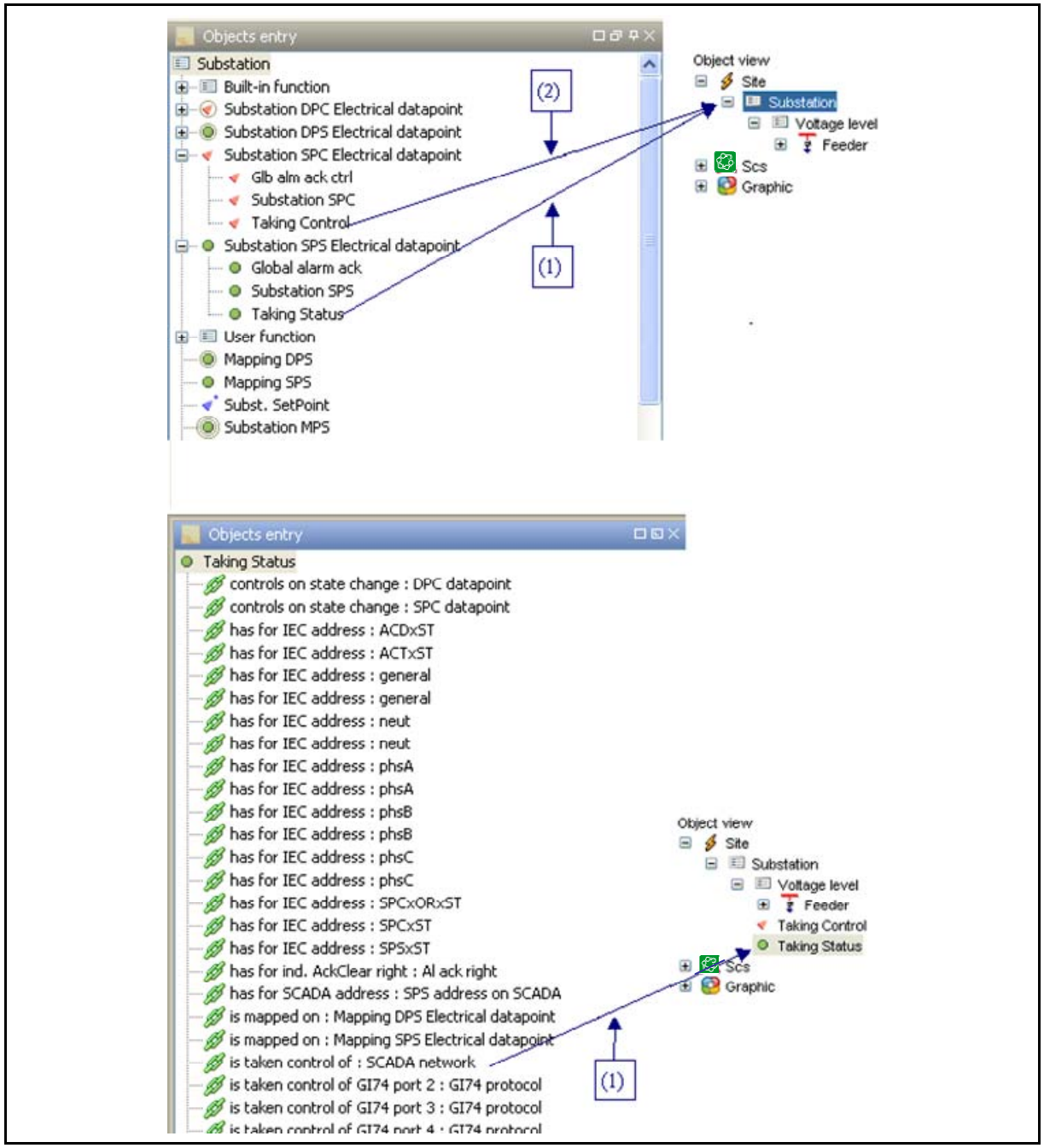


FIGURE 61: DEFINING TAKING CONTROL FOR A SCADA LINK

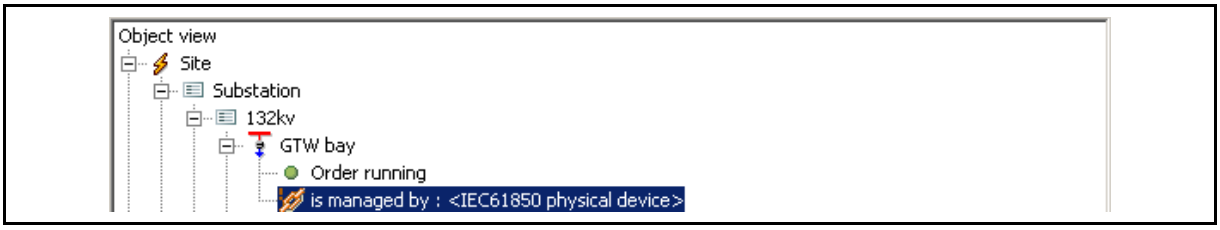
Configuration rules and checks

- If, at least, one SCADA network is linked to a Taking Control function, all the SCADA Networks of the system must be linked to a Taking Control function.
- If a "Taking Status" datapoint is linked to a SCADA Network, it must also be linked to a "Taking Control" datapoint through the relation "has for feedback".
- A "Taking Control" datapoint must be linked to a "Taking Status" datapoint through the relation "has for feedback".
- The "Taking Control" datapoint must have its "activation mode" attribute set to a "Permanent…" value. The "Taking Status" datapoint must have its "detection mode" attribute set to the "Permanent" value.
- Both "Taking Control" and "Taking Status" datapoints must be linked to a SCADA address in the mapping of their SCADA network.
- If a Taking-Control function is defined then, the "Loc/rem ctrl DPC" for substation must be present and not wired.
- The Server of the Local/Remote Datapoints is the **Server** of each Datapoints couple "Taking Status" / "Taking Control".
- All the devices having a SCADA network linked to a Taking-Control function are:
  - **Clients** of each Datapoints couple "Taking Status" / "Taking Control".
  - **Clients** of the Datapoints couple "Local/remote DPS" / "Loc/rem ctrl DPC".

5.4 Defining an ISaGRAF RT automation

An object UCA2/IEC gateway object has been already created in the system architecture (refer to 4.1).

Under the Voltage level, create a Generic bay:



Click twice on the link **is managed by** and select the UCA2/IEC gateway object.

The core of modeling is a 'RT automation' object that is equivalent to an ISaGRAF project. RT automation can own data points for status, control of automation itself (automation management); for instance, a load shedding automation can have a control to put it in/out of service and a relevant status. For ISaGRAF general description, refer to SCE_EN AP. It is recommended to use only single database libraries i.e. to store them inside the SCE project.

Data points have to be referenced, located in system or electrical architectures via links:

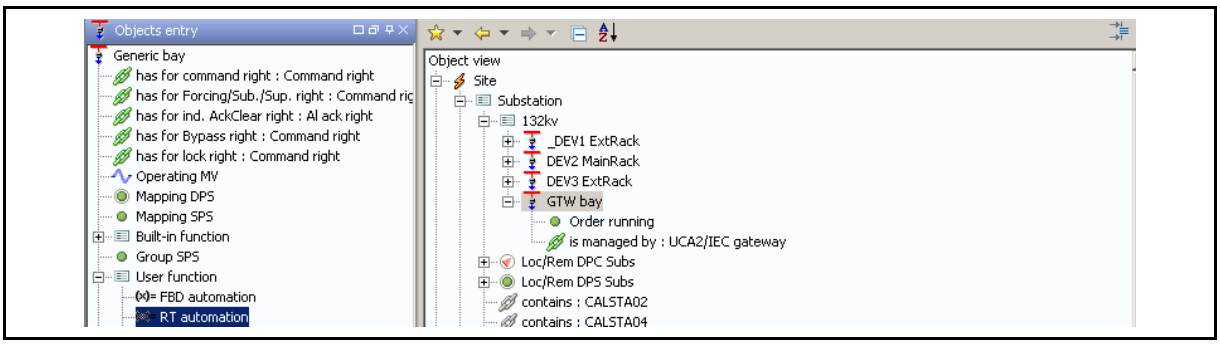
- '**client**' link, meaning the RT automation uses the datapoint, acquired or managed outside the ISaGRAF automation or managed outside the ISaGRAF automation. For instance, the load shedding automation can be client of some 'circuit-breaker status' input datapoints and some 'circuit-breaker control' output datapoints.
- '**server**' link, meaning the RT automation produces or manages the datapoint. For instance, a slow automation can be used to produce the sum of feeder measurements. This sum is also a measurement located at voltage level for instance.

To define RT automation, do the steps that follow:

1. Define the RT automation interface:
   - create the RT automation 'header'
   - if required, create the datapoints at RT automation level, used for the management
   - create the client links for the RT automation
   - create the server links for the RT automation
2. Define the RT automation body by launching from the SCE the ISaGRAF editor (contextual menu on the RT automation interface object) and using available languages and the client/server links defined above
3. Compile ISaGRAF automation

5.4.1 Creating an ISaGRAF RT automation (header definition)

To add ISaGRAF RT automation, tap into the **Objects entry** window's User function binder at the generic bay level: select **RT automation** and right click > **Add/double click.**



NOTE: Does not add **FBD automation** or **Slow automation** into the window's User function binder supported by C264 only.

To include several RT automation instances in the same binder, repeat the preceding step at the Automation binder level.

ISaGRAF RT automation features must be set:

1. Edit the relation **runs on**, to assign a computer PLC to manage the automation. This relation is automatically established by the SCE if the RT automation is located under a bay whose computer manager has ever been entered (inheritance mechanism)
2. Enter attributes:
   - **short name** and **long name** of the RT automation (used in logging and alarm)
   - **modified**: Yes/No (NOTE 1)
   - **Automation Id**: automatically assigned number of the RT automation instance
   - **Resource number**: 1 thru 8 (see NOTE 2)
   - **Master resource**: Yes/No (see NOTE 2)

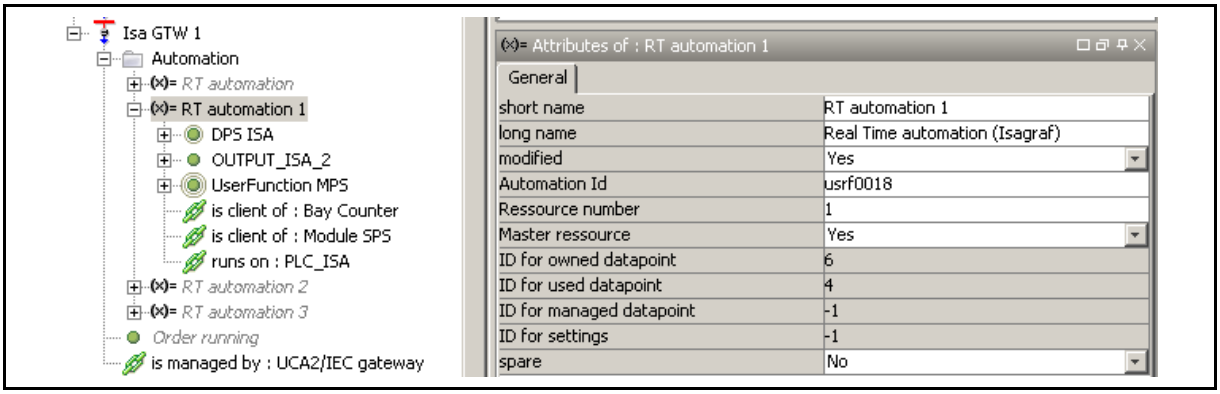
ID for owned datapoint : (read only SCE calculation)

ID for used datapoint (read only SCE calculation)

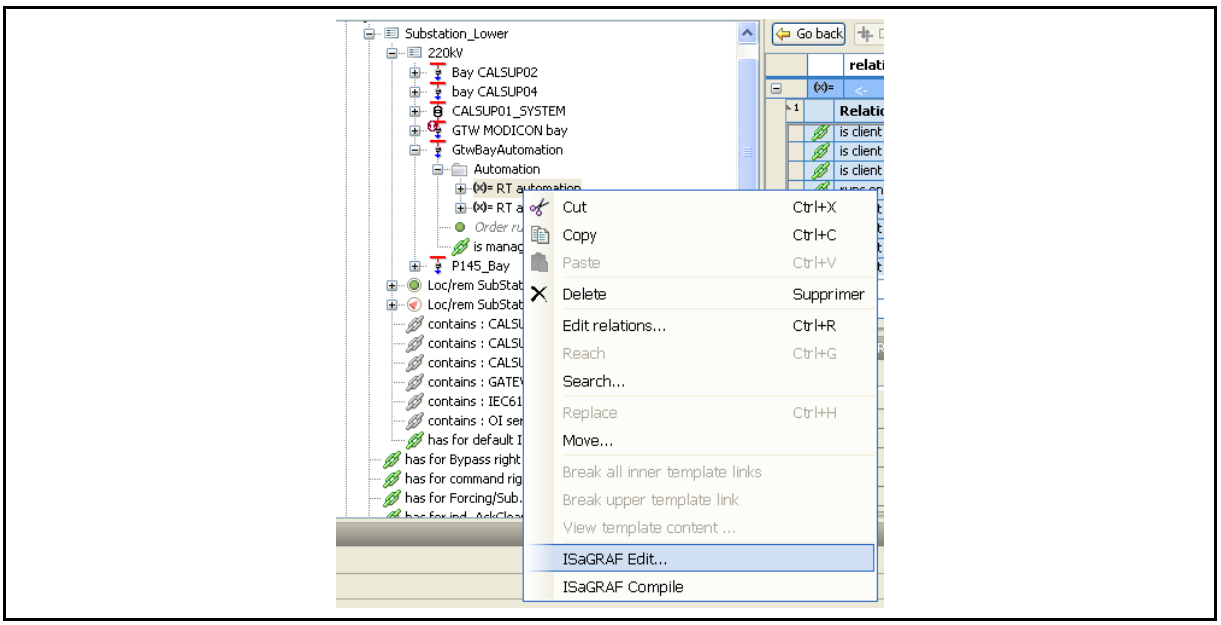
ID for managed datapoint : (read only SCE calculation)

ID for settings : (read only SCE calculation)

   - **spare**: Yes/No (refer to C264_EN AP, section 3.3)

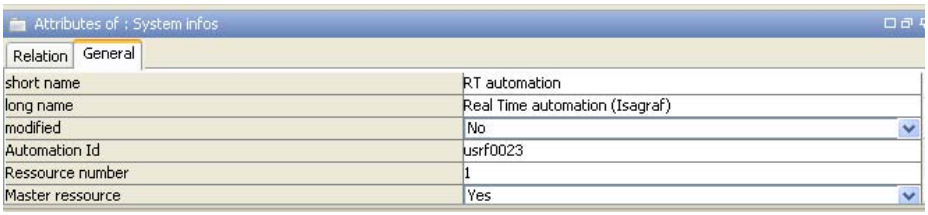


NOTE 1: This field is updated to **Yes** when the RT automation is edited and updated to **No** after compilation

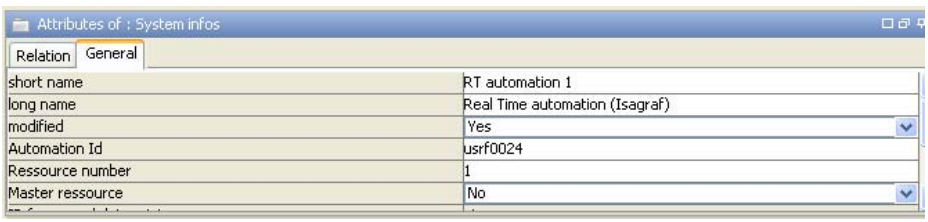


NOTE 2: It is mandatory to have one Master resource by resource; In case of two RT automations are linked with same resource, one of them has to be a Master resource and the other not.

The resource is 1 and the RT automation is Master resource:



The resource is 1 and the other RT automation is NOT a Master resource:

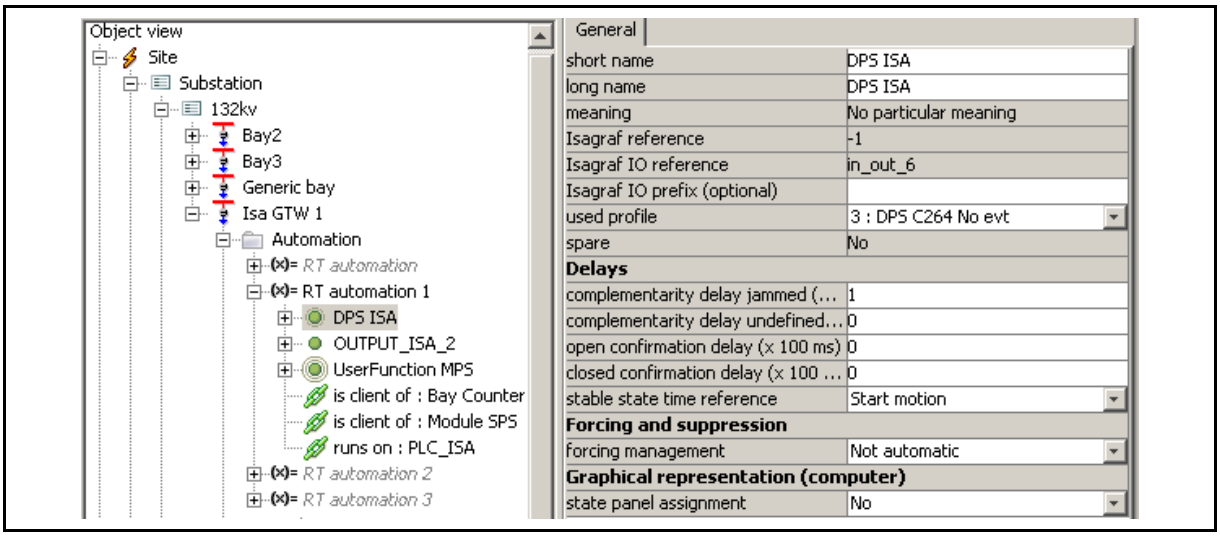


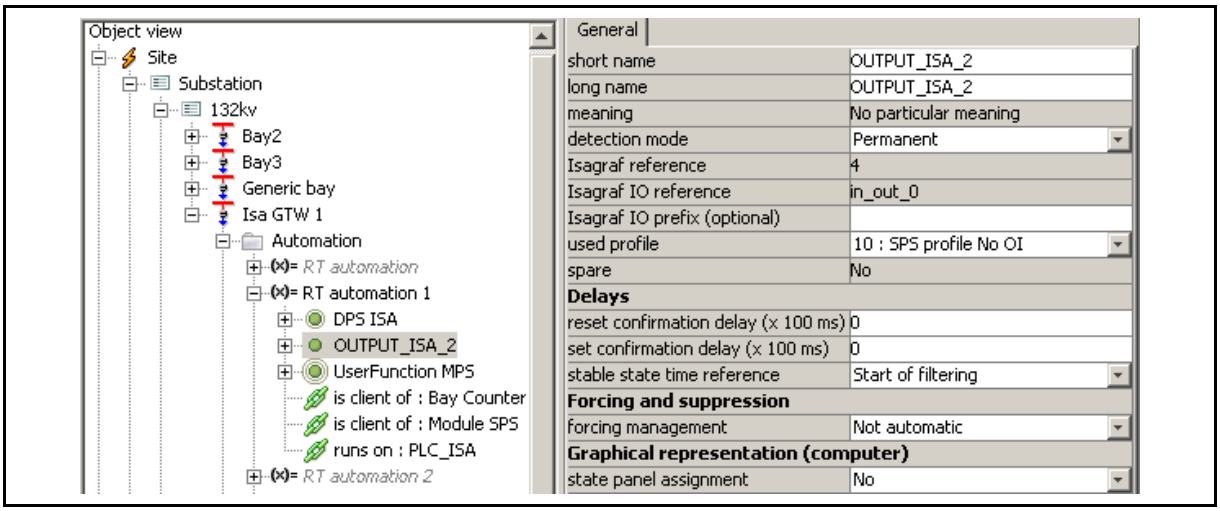
5.4.2 Adding specific datapoints to RT automation (interface definition)

To add an RT automation datapoint, tap into the **Objects entry** window at RT automation level: select a datapoint and right click >**Add/double click.**

Special attributes:

- **Isagraf reference**: integer, equivalent to address
- **Isagraf IO reference**: refer to SCE_ENAP section 3.2.5
- **Isagraf IO prefix** (optional): inherited by child links





RT automation datapoint is integrally produced or managed by the RT automation and subsequently by ISaGRAF. It can not be linked to another acquisition or control source and the ISaGRAF project must update/run its value changes or controls.

RT automation input datapoints are stored in a non-volatile Flash memory to restart on their latest known values in event of GTW reboot.

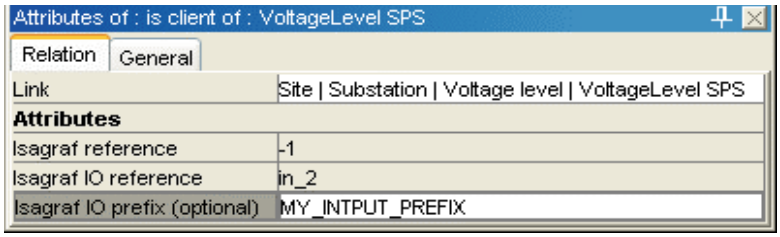
5.4.3 Creating ISaGRAF client link (interface definition)

To add an RT automation datapoint, tap into the **Objects entry** window at RT automation level select the relation **is client of** and right click > **Add/double click.** Choose the correct relation depending on the datapoint kind to use.

1. To link a datapoint to an ISAGRAF client link, define the relation **is client of**. For that double click this relation. This displays the Relation Link Editor. Expand the tree view to list all the available datapoints. Click the one you want to link then the Ok button. The link symbol turns green.

2. To define ISAGRAF IO prefix for an input, select the **client of** relation in order to display the associated attributes window. Only the **Isagraf IO prefix** attribute can be modified by the user. This attribute defines the prefix of the identifier of this datapoint when used in ISaGRAF workbench as an input signal of the automation.

Link Identifier syntax: Prefix Underscore (if the prefix exists) ISaGRAF IO reference (automatically given by the SCE). In the example given hereafter the identifier of this link will be: MY_INPUT_PREFIX_in_2.



Rules:

– first character: letter only

– following characters: capital, digit or underscore

– maximum length: 80 characters

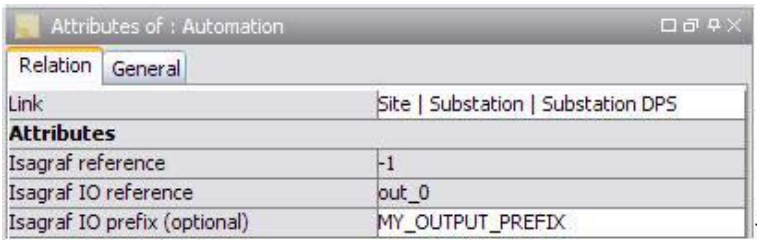
5.4.4 Creating ISaGRAF server link (interface definition)

1. To add an ISaGRAF server, tap into the **Objects entry** window at the RT automation level by clicking on mouse's right button and add a **manages** relation. Choose the correct relation depending on datapoint kind to manage.

2. To link a datapoint to an ISaGRAF server link the relation manages must be defined. For that double click this relation. This displays the Relation Link Editor. Expand the tree view to list all the available DPS datapoints. Click the one you want to link then click the Ok button. (In the example given hereafter the link has be done with the Substation DPS datapoint). The link symbol turns green.

3. To define ISaGRAF IO prefix for an output, select **manage**s relation to display the associated attributes window. Only the **Isagraf IO prefix** attributes. This attribute defines the prefix of the identifier of this datapoint when used in ISaGRAF workbench as an output signal of the automation.

Link Identifier syntax: Prefix Underscore (if the prefix exists) ISaGRAF IO reference (automatically given by the SCE). In the example given hereafter the identifier of this link will be: MY_OUTPUT_PREFIX_out_0.



Rules:

– first character: letter only

– following characters: capital, digit or underscore

– maximum length: 80 characters

5.4.5 Using ISaGRAF editor (body definition)

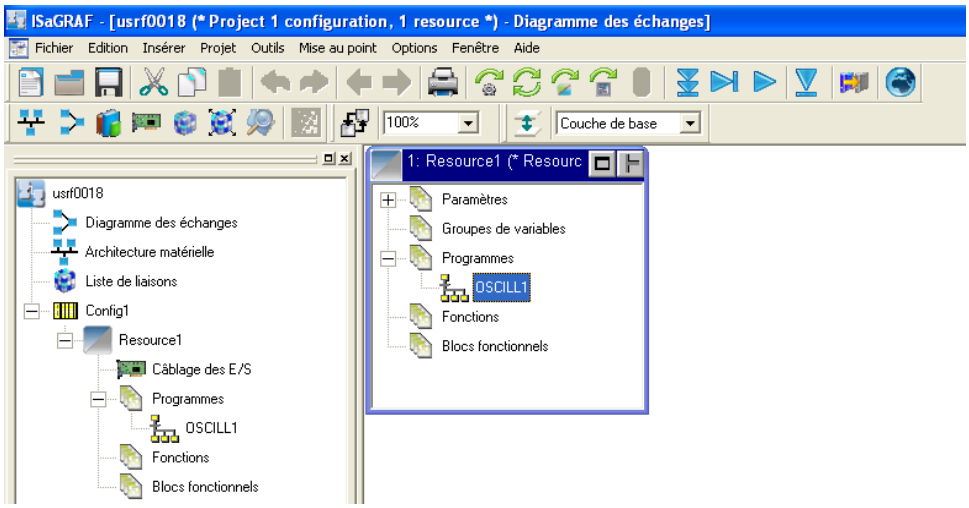
Insert the dongle as far as the project has to be edited or compiled.

To launch the ISaGRAF editor at an RT automation level, right click **Isagraf Edit**.

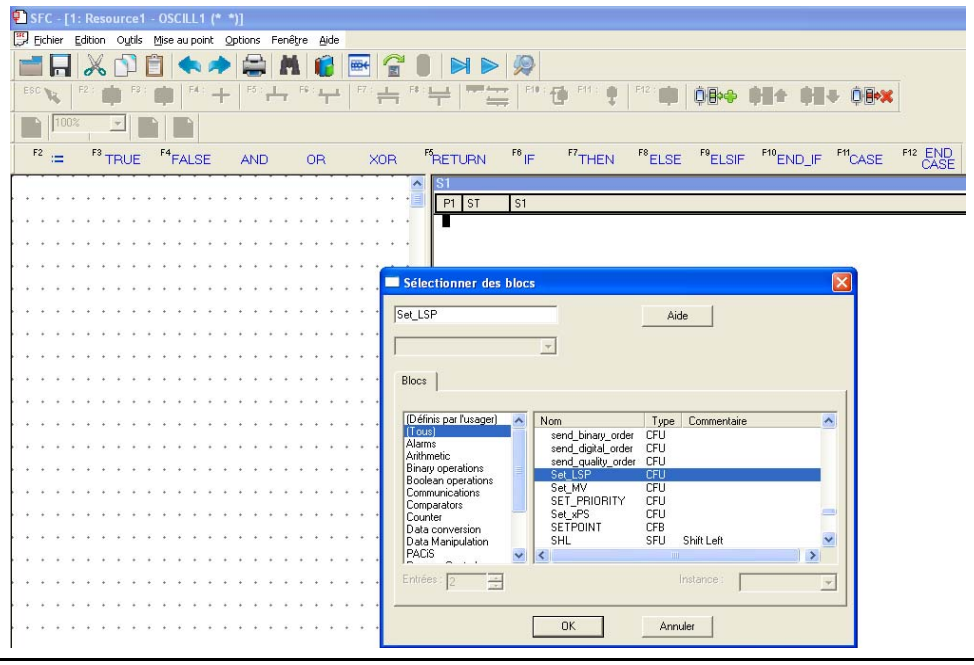
ISaGRAF editor allows diagram edition of the automation. For details about ISaGRAF workbench and SCE datapoint coupling, refer to SCE_ENAP.

Contextual help for PACiS functions:

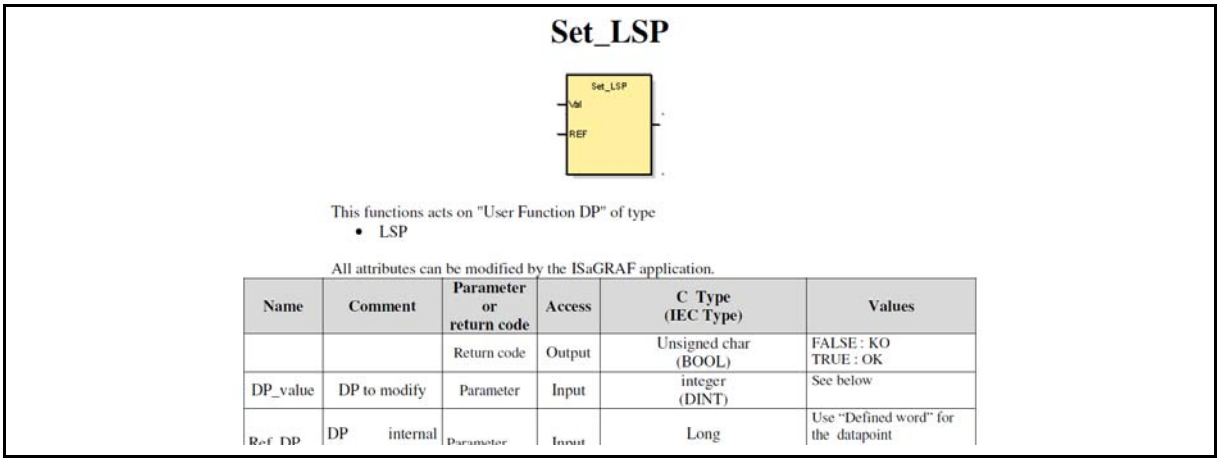
1. Expand Programs; this displays the projects.



2. Double click a project; this displays the programming area
3. Click on programming area
4. Goto edit menu and select insert/set block
5. Now select different function used by PACiS
6. Select the menu Insert/define block
7. Select a function used by PACiS:



8. Click the button Help; this display the function sheet:



Set_LSP

This functions acts on "User Function DP" of type

- LSP

All attributes can be modified by the ISaGRAF application.

Name	Comment	Parameter or return code	Access	C Type (IEC Type)	Values
		Return code	Output	Unsigned char (BOOL)	FALSE : KO TRUE : OK
DP_value	DP to modify	Parameter	Input	integer (DINT)	See below
Ref_DP	DP internal	Parameter	Input	Long	Use "Defined word" for the datapoint

Gateway redundancy

Limitation: The ISaGRAF redunded is not supported.

6. DEFINING IEC61850/IEC61850 PACIS GATEWAY CONFIGURATION

An IEC61850/IEC61850 GTW connects two IEC61850 station bus networks called the lower network and the upper network.

In this section is described the way to configure the GTW on both networks

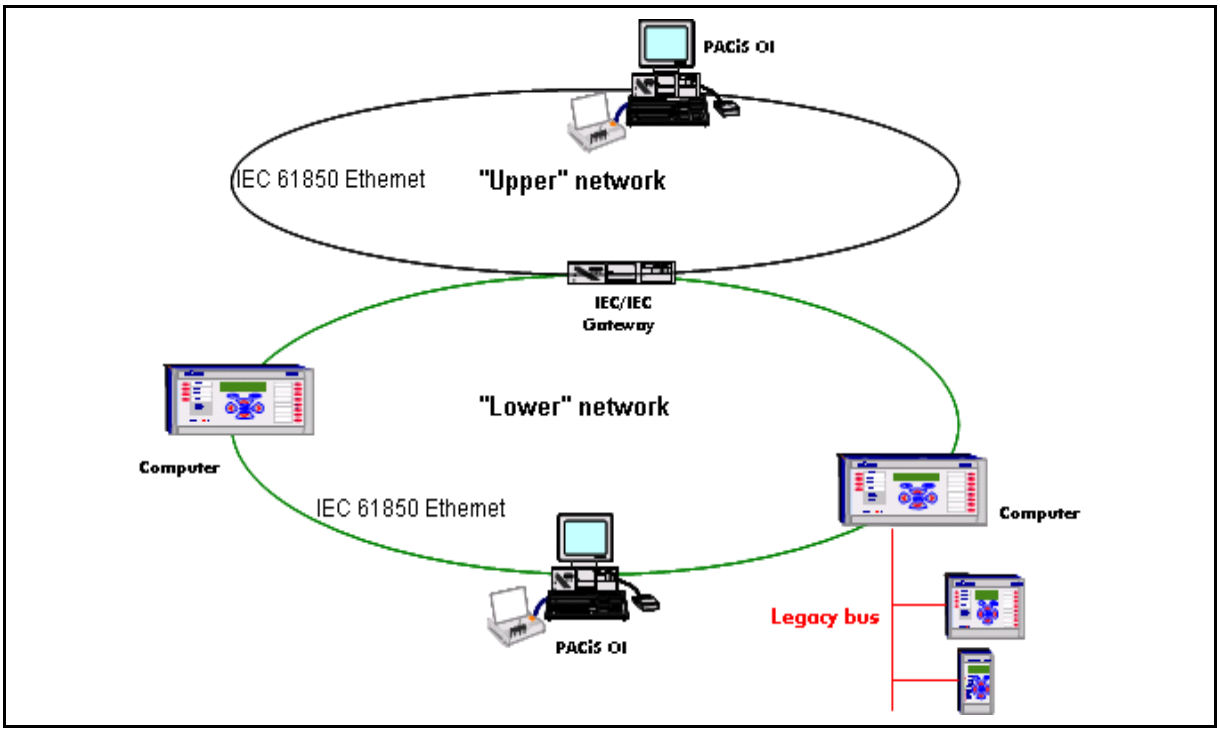


FIGURE 62: TWO-NETWORK ARCHITECTURE

6.1 Configuring the GTW in the lower network

The actions described below are the last actions the user has to process.

It's assumed that the user has already built the configuration for this network. In the example given hereafter the name of the database is **Energy_lower.mpc**

CAUTION: MAKE SURE THAT IN THIS DATABASE, ALL THE ENTITY'S NAMES ARE UNIQUE, ENTITY MEANS SUBSTATION, VOLTAGE LEVEL, BAY, MODULE, DATAPOINT, IEC PHYSICAL DEVICE.

1. Open this database, add a GTW. Enter the name and the TCP/IP address of this GTW on the lower network (GTWT101M, 192.168.0.15 in our example).

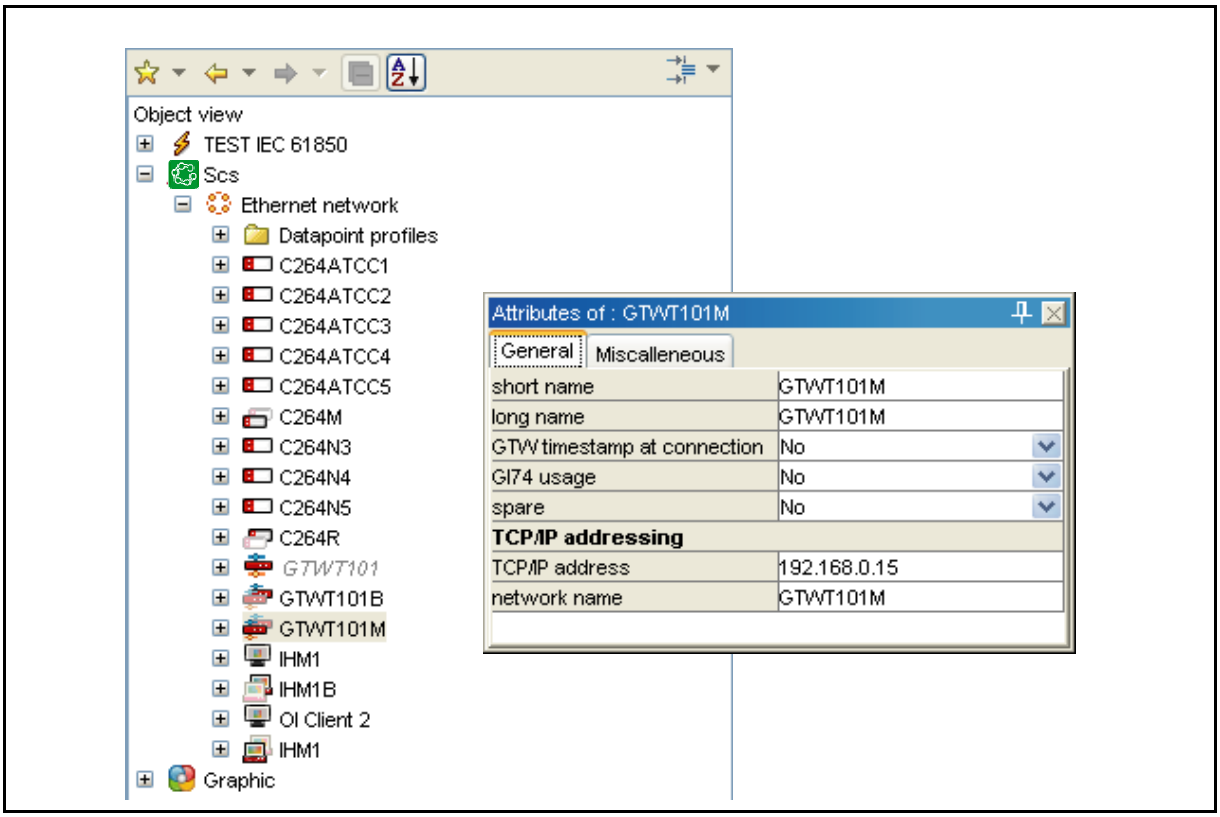


FIGURE 63: GENERAL ATTRIBUTES OF THE GTW IN THE LOWER NETWORK

2. Add an IEC61850 protocol SCADA network to this GTW, then enter the TCP/IP address of this GTW on the upper network, in example: 192.169.0.55

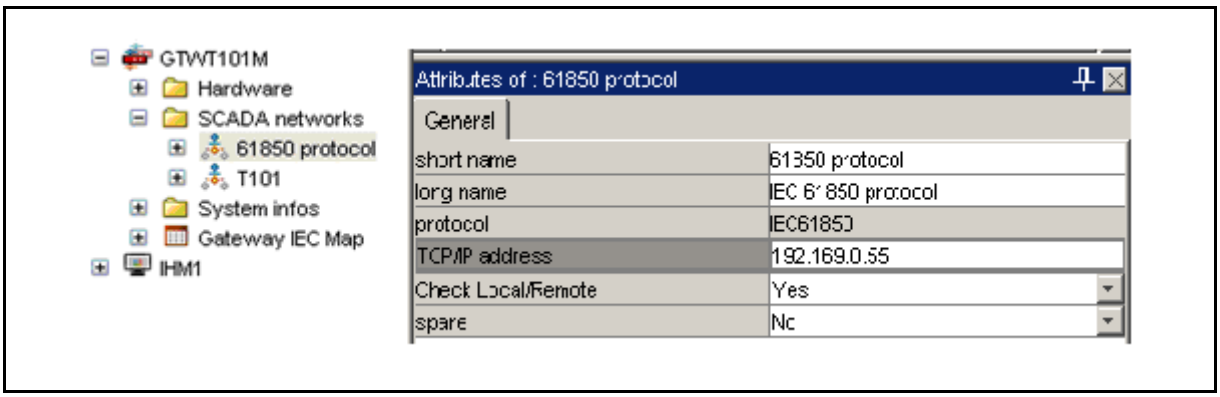


FIGURE 64: GENERAL ATTRIBUTES OF THE IEC61850 SCADA PROTOCOL

The attribute "**Check** Local**/Remote**" defined if the SubstationLocal/Remote information has to be used by an IEC61850/IEC61850 gateway. The Substation Local/Remote xPS comes from the lower IEC61850 network.

If the L/R is managed (attribute to YES), the controls coming from the upper network:

- are sent to the lower network if the Substation mode is “Remote” and if the controls are dependent on the L/R mode
- are sent to the lower network if the controls are independent on the L/R mode
- are negatively acknowledged (“bay-substation mode fault” ack) if the Substation mode is “Local” and if the controls are dependent on the L/R mode

If the L/R is not managed (attribute to NO), the controls coming from the upper network are sent to the lower network whatever is the L/R state.

3. From the IEC61850 protocol, launch the "Edit relation" in the contextual menu, click on the tab "**To**", click on the item "**transmits: Datapoint [0..65535]**".

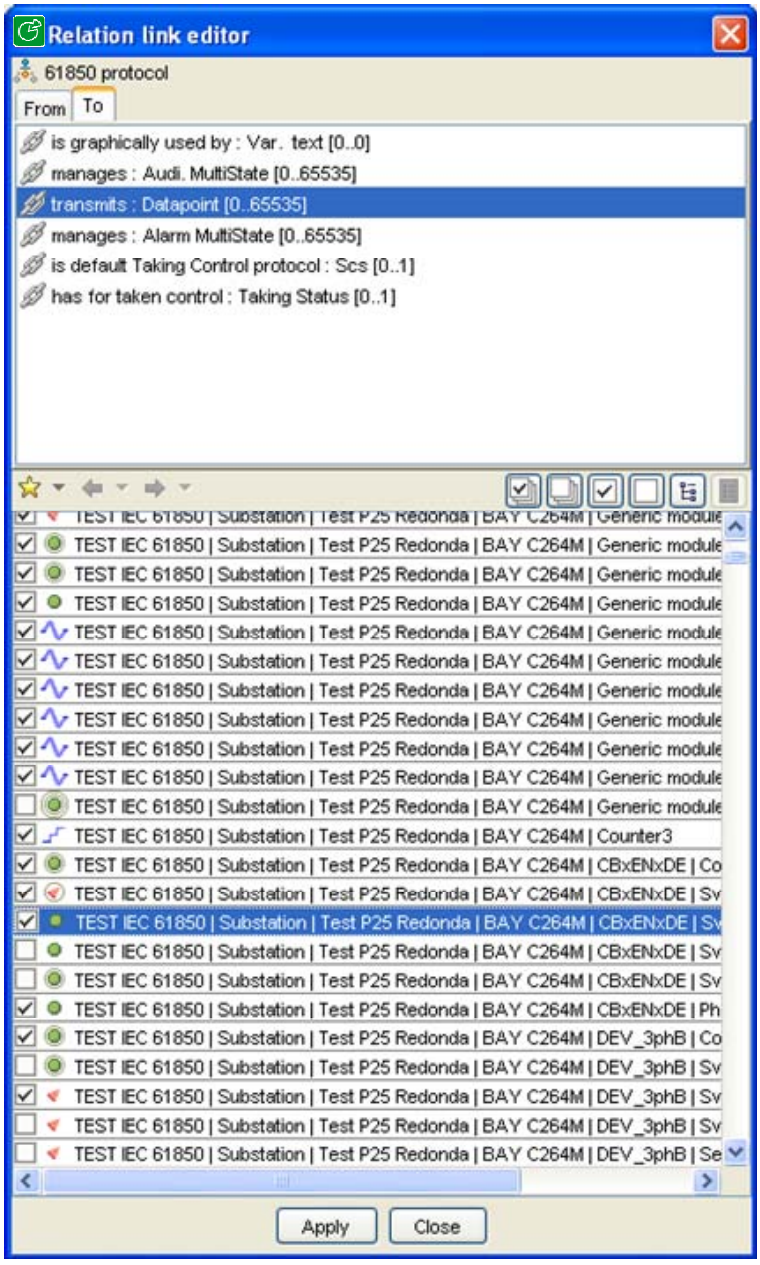

Relation link editor
61850 protocol
From
To
is graphically used by : Var. text [0..0]
manages : Audi. MultiState [0..65535]
transmits : Datapoint [0..65535]
manages : Alarm MultiState [0..65535]
is default Taking Control protocol : Scs [0..1]
has for taken control : Taking Status [0..1]
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | Generic module
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | Counter3
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | CBxENxDE | Co
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | CBxENxDE | Sv
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | CBxENxDE | Ph
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | DEV_3phB | Co
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | DEV_3phB | Sv
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M | DEV_3phB | Se
Apply
Close

FIGURE 65: DEFINING DATAPOINTS TO BE TRANSMITTED TO THE UPPER NETWORK

In the list of datapoints which can be linked to this protocol select those you want to be transmitted to the upper network and then click the **Apply** button.

Do not select the Operating mode of the GTW. Do not transmit the Operating mode of GTW from lower network to upper network.

Please note that the selected datapoints must have an IEC address.

4. "Check in" (release **13.3** in our example) and "Generate" the lower database.

Before starting the next steps, make sure that the files: **Energy_lower.13.3.bup.zip**, **Energy_lower.13.3.zip** and **Energy_lower.13.3.scadaSbusDm.zip** are under the directory target of the generation.

5. Extract the **GTWT101M_PROT1_13.3.xml** file from the **Energy_lower.13.3.scadaSbusDm.zip** archive.

6. Copy the lower database file (Energy_lower.mpc) in order to use it as base of work for the upper database file (Energy_upper.mpc).

6.2 Configuring the GTW in the upper network

The actions described below are the first actions the user has to process.

1. Open the upper database (Energy_upper.mpc) and delete all IEC physical devices from system part (Scs), all FBD equations. Do not change the name of the substation. On the Scs node, change the TCP/IP addressing for SMT and for SNTP server.

2. In case of multiring architecture (i.e. the use of IEC61850/IEC61850 gateway), the OI which is client of the IEC/IEC gateway will be able to display interlock viewer.

   NOTE: The ILK bypass is not allowed from this OI

3. On the system part, add an" IEC generic IED", set its short name, long name, network name and its TCP/IP address the same as the IEC61850/IEC61850 GTW on the lower network, in our example: GTWT101M and TCP/IP address: 192.169.0.55

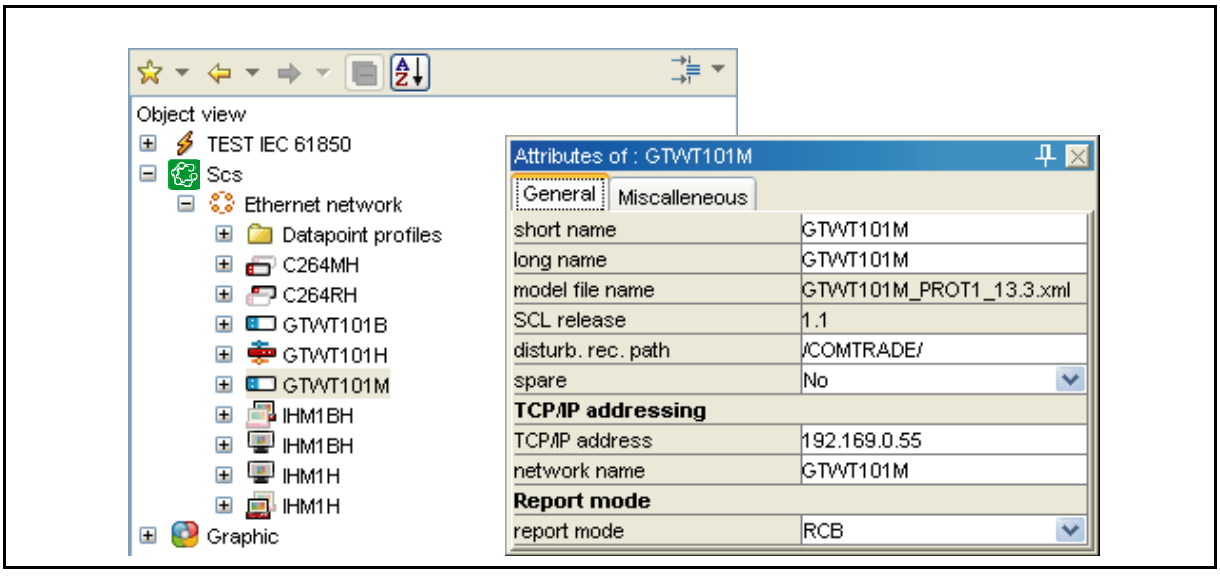


FIGURE 66: GENERAL ATTRIBUTES OF THE GTW IN THE UPPER NETWORK

4. From the GTW, launch the "Edit relation" in the contextual menu, click on the tab "**To**", click on the item "**manages: Bay [0..65535]**".

The list of bays which can be managed by the GTW is displayed. Select those you want to be managed by the GTW, then click the **Apply** button. Datapoints you wish to use on the upper network need to be part of the selected bays.

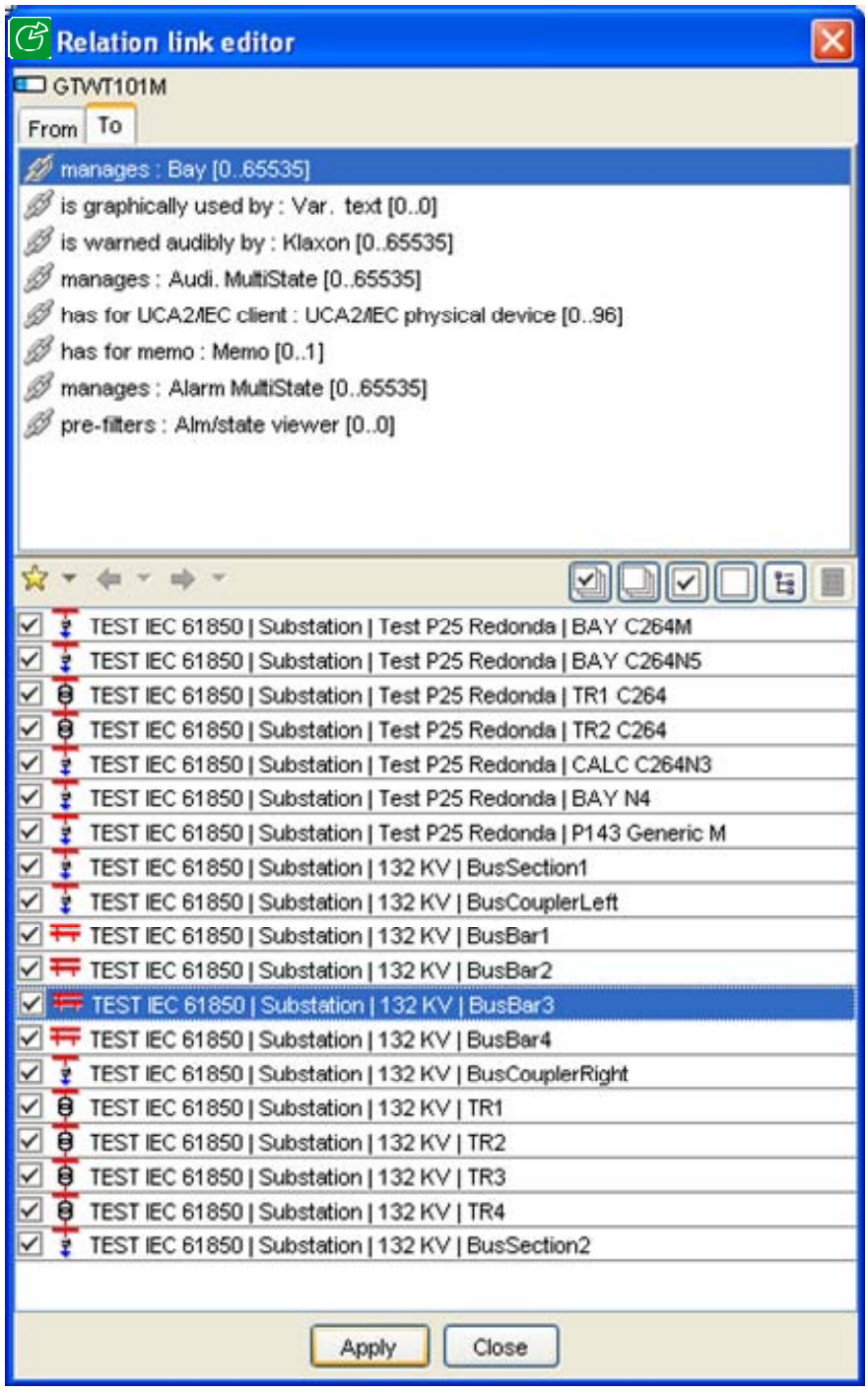

Relation link editor
GTWT101M
From
To
manages : Bay [0..65535]
is graphically used by : Var. text [0..0]
is warned audibly by : Klaxon [0..65535]
manages : Audi. MultiState [0..65535]
has for UCA2/IEC client : UCA2/IEC physical device [0..96]
has for memo : Memo [0..1]
manages : Alarm MultiState [0..65535]
pre-filters : Alm/state viewer [0..0]
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264M
TEST IEC 61850 | Substation | Test P25 Redonda | BAY C264N5
TEST IEC 61850 | Substation | Test P25 Redonda | TR1 C264
TEST IEC 61850 | Substation | Test P25 Redonda | TR2 C264
TEST IEC 61850 | Substation | Test P25 Redonda | CALC C264N3
TEST IEC 61850 | Substation | Test P25 Redonda | BAY N4
TEST IEC 61850 | Substation | Test P25 Redonda | P143 Generic M
TEST IEC 61850 | Substation | 132 KV | BusSection1
TEST IEC 61850 | Substation | 132 KV | BusCouplerLeft
TEST IEC 61850 | Substation | 132 KV | BusBar1
TEST IEC 61850 | Substation | 132 KV | BusBar2
TEST IEC 61850 | Substation | 132 KV | BusBar3
TEST IEC 61850 | Substation | 132 KV | BusBar4
TEST IEC 61850 | Substation | 132 KV | BusCouplerRight
TEST IEC 61850 | Substation | 132 KV | TR1
TEST IEC 61850 | Substation | 132 KV | TR2
TEST IEC 61850 | Substation | 132 KV | TR3
TEST IEC 61850 | Substation | 132 KV | TR4
TEST IEC 61850 | Substation | 132 KV | BusSection2
Apply
Close

FIGURE 67: DEFINING THE BAYS TO BE MANAGED BY THE GTW

5. At this stage, you can import the xml model **GTW_IEC_PROT1_13.3.xml** file.

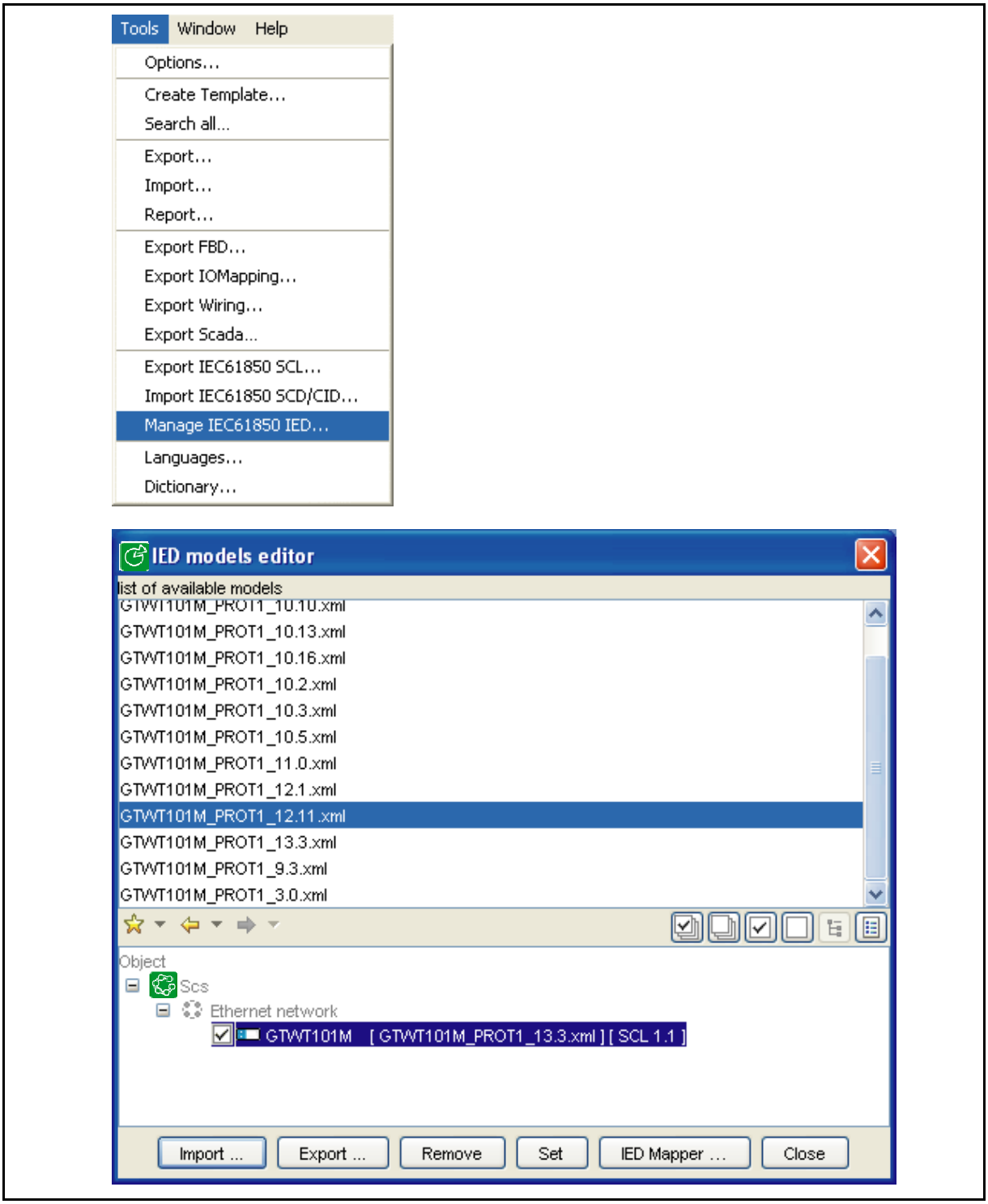


FIGURE 68: IMPORTING THE XML MODEL OF THE GTW

6. Click on “Import…” to browse the PC in order to find out the xml file

7. In the upper box, select the xml file, then in the bottom listbox, select the GTW then Click on “Set” button (a message box is displayed “IED model import in progress please wait”.)

8. Click on “Close” (a message box is displayed “IED model setting in progress, please wait")

At the completion of the import process, check that all "has for IEC address" relations in the electrical part are filled with the right logical device.

9. On GTW_IEC, change the short name and long name of the Operating mode of the GTW_IEC. These names must not be the same as name of Operating mode of the GTW on the lower network

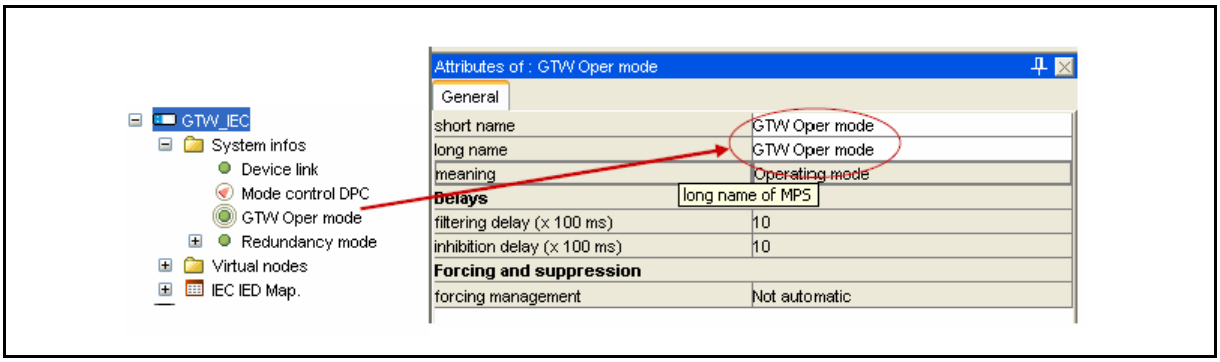


FIGURE 69: CHANGE SHORT NAME & LONG NAME OF OPERATING MODE

10. Change the "short name", "long name", "network name" and "TCP/IP address" of OI server to be compatible with upper network.

11. Fill the relation between OI server and IEC/IEC GTW (named "has for IEC61850 server").

12. Check in and generate the upper database before completing the rest of the configuration.

7. DEFINING PACiS GATEWAY INITIALIZATION TIMER

In order to avoid the transmission of transitory states to the SCADAs due to the starting of the GTW (or a switching into the operational mode), a timer can be configured in registry (key “timer init”). This functionality is active if the value of the timer (expressed in seconds) is greater then 0.

During the starting phase and until the end of the timer, no message is sent to the protocols. At the end of the timer, the GTW performs a general control and sends to the protocols all the configured data. Data belonging to non-present pieces of equipment shall be set to “unknown” state with the GTW time-stamp.

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FUNCTIONAL DESCRIPTION

CONTENT

1.	**INTRODUCTION**	**3**
1.1	**Scope of the document**	**3**
1.2	**Main features**	**3**
2.	**PROCESS INTERFACE**	**4**
3.	**PACiS GATEWAY MANAGEMENT**	**7**
3.1	**Configuration management**	**7**
3.1.1	Configuration tool	7
3.1.2	Downloading tool	7
3.2	**Database management**	**7**
3.3	**Time management**	**8**
3.4	**Exploitation mode management**	**8**
3.4.1	Substation Remote/Local mode checking	8
3.4.2	SBMC mode checking	8
3.4.3	Taking Control	8
3.5	**Redundancy management**	**8**
4.	**COMMUNICATION LAYER**	**9**
4.1	**Telecontrol bus**	**9**
4.2	**Station bus**	**10**
4.3	**Loss of communication**	**10**
5.	**SBUS ACQUISITION**	**11**
5.1	**IEC 61850 acquisition**	**11**
5.2	**IEC 61850 supported Common Class**	**11**
5.3	**IEC 61850 Controls**	**12**
5.4	**IEC61850/61850 PACiS GTW**	**12**
5.5	**Redundant IEC61850/IEC61850 PACiS GTW**	**13**

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1. INTRODUCTION

1.1 Scope of the document

This document is a chapter of the PACiS Gateway (GTW) documentation. It is the functional description (FT) of the PACiS GTW between PACiS system and SCADA. The hardware description is defined in HW (Hardware) chapter. The product capabilities, specifications, environmental limits are grouped in TD (Technical Data) chapter.

1.2 Main features

The PACiS GTW is in charge of data exchange between two networks: the PACiS Network with its IEC 61850 devices and the dedicated network with remote SCADA (Supervisory Control And Data Acquisition). Several protocols are implemented to make available communication with SCADA.

The implemented SCADA protocols are:

- IEC 60870-5-101
- IEC 60870-5-104
- Serial link GI74 (this protocol is not available if PACiS GTW OS is Windows XP Embedded)
- Modbus
- DNP3
- CDC type II (this protocol is not available if PACiS GTW OS is Windows XP Embedded)
- OPC (this protocol is not available if PACiS GTW OS is Windows XP Embedded)
- IEC 61850
- T101-SAS

2. PROCESS INTERFACE

In PACiS system, direct process acquisition is done by MiCOM C264 Computers and IEDs. All data are presented on the Station BUS IEC61850. The PACiS GTW gets all supervisory information on SBUS network and stores them into its kernel. It is then able to transmit data to SCADA when it asks for them. The PACiS GTW has several protocols implemented into DLL. There is one DLL started per communication link with the SCADA to allow possibly several ways of transmission of the same data.

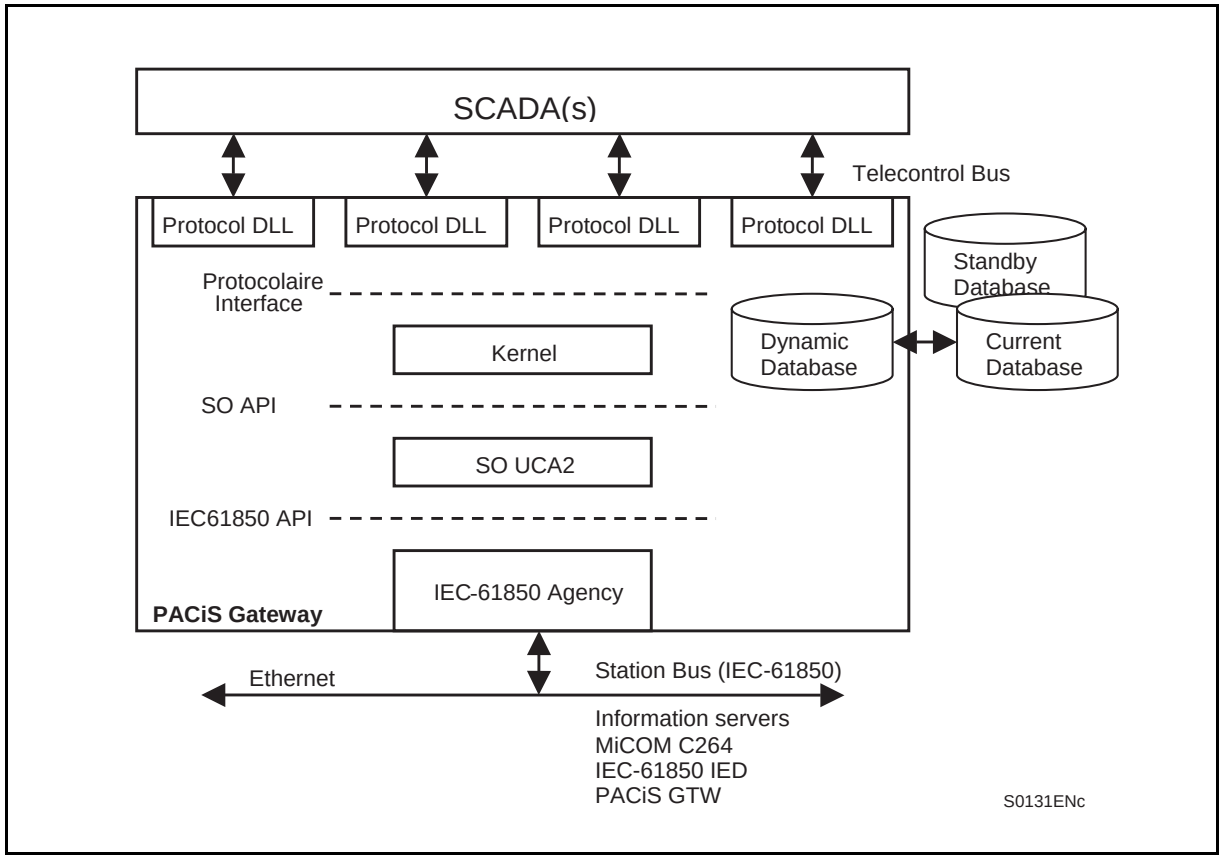


FIGURE 1: PACiS GTW ARCHITECTURE

PACiS GTW is then composed in three modular parts:

- Acquisition DLL:
  - IEC 61850 agency
- Kernel storing data changes
- Protocol DLL

To know the data to catch on SBUS and their respective mapping on SCADA Protocol, the PACiS GTW uses a current database loaded from its hard disk at start-up. A second or stand-by database is used for new database download while current is running.

PACiS GTW runs ISaGRAF automation applications :

To prevent C264 from being overloaded, it is possible to run ISaGRAF automation applications on the GTW. Thus the GTW can communicate via binding mechanism with lower and higher level computers. Station level functions are available such as:

- station automation for macro commands to several bays
- statistics
- head of distributed applications

The ISaGRAF real-time automation uses RTX 2009, a deterministic real-time extension available for Win32 platforms and communicates with the Kernel.

RTX extends the Windows HAL, and controls system resources and is guaranteed to execute ahead of all Windows threads, Deferred Procedure Calls, and interrupts. This means that RTX allows Windows to run only when all real-time processing is finished.

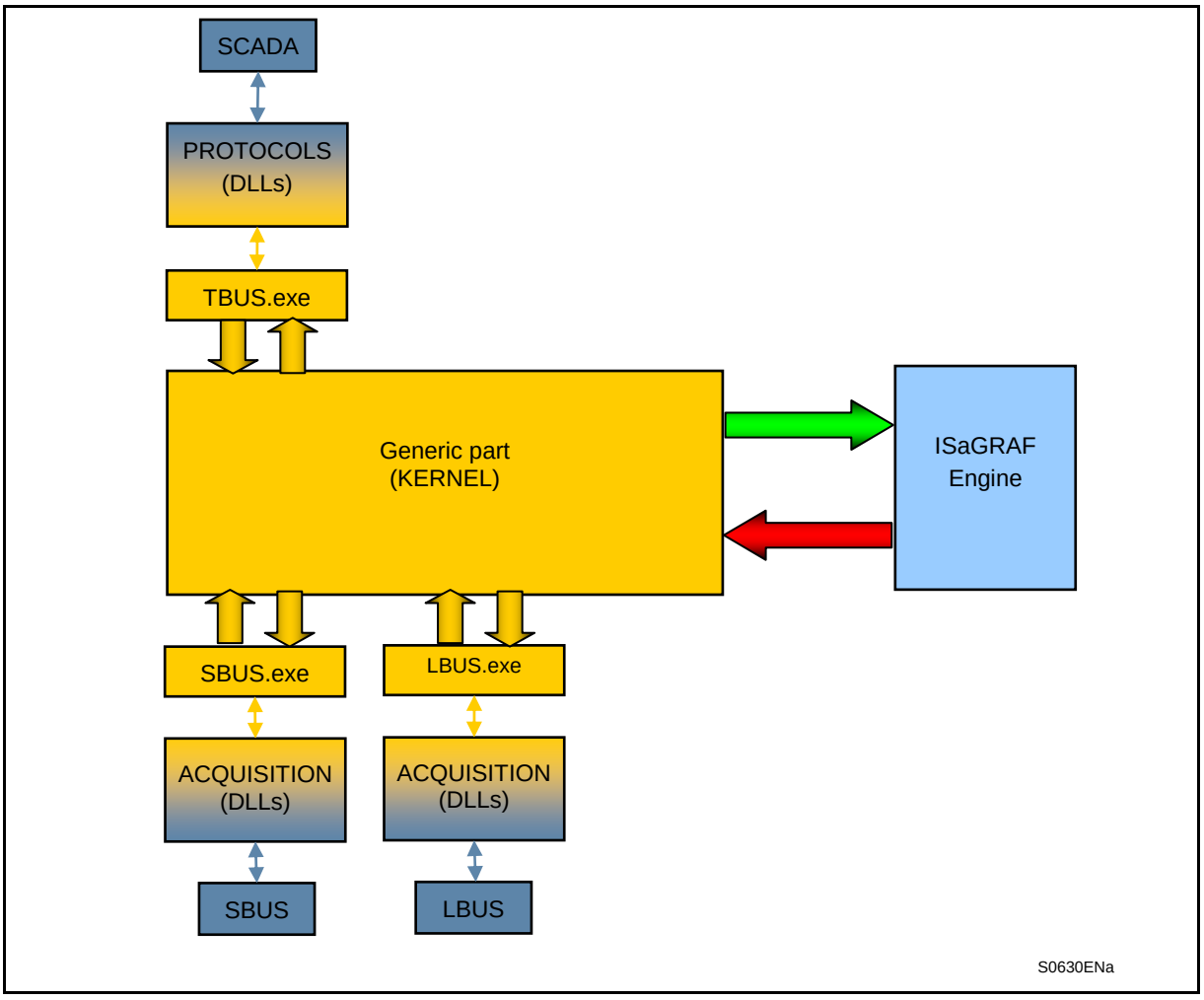
For details on ISaGRAF, refer to SCE/EN AP, for specific use with GTW, refer to the AP section.

The ISaGRAF runtime engine exchange data with the kernel. There is no direct access to protocol or acquisition DLLs.

The kernel task is in charge of starting the ISaGRAF runtime engine upon startup:

It creates message pipes between kernel and ISaGRAF

It launches a specific task called IsaGTW.exe



The resource combines a cyclic mode (cycle to cycle) and an acyclic (event driven i.e. real-time) mode:

- cyclic: the events are stored in the Kernel FIFO stack and one event on a given data point is extracted at each cycle.
- Event driven: ISaGRAF resource starts a new cycle immediately on event reception; this mechanism avoids waiting too long after an event receipt before operating, and also reduces the number of stacked events as soon as possible.

Limitations for GTW:

- The ISaGRAF is supported with mono resource only with the simplex GTW.
- The ISaGRAF redunded is not supported with the redundant GTW.

1. Inputs = control from SCADA or DI/AI from IED (legacy or IEC 61850)
2. Outputs = controls to IED (legacy or IEC 61850) and DI/AI to SCADA and IED 61850
3. No GOOSE management, only REPORT on S-Bus

Hooks in the ISaGRAF target are empty functions that the user can write to make a specific action at a particular position in the cycle. GTW_Isa uses the hooks that follow:

ook function	Call position	Role
kerHookRStart	Starting the resource	Creates environment for exchanges with IsaGTW.exe
kerHookRStop	Stopping the resource	Deletes environment created for exchanges with IsaGTW.exe
kerHookEndOut	End of cycle	Unstack all events coming from kernel

GTW_RT:

Define (ITGTDEF_XXX)	Role	Usable
USF/FBLOCK	Allows ‘C’ fct and Fct blocks	x
CNV/ RTIOCNVGAIN/ IOCHANOEM	Enables functions for I/O channels	
FLOAT/STRING/DOUBLE/INT64	Enable special data types	x
MODIF	On-line modification feature	x
PRINTF	Enables display of target	
RETAIN	Retain variables	x
ITGTDEF_SFCEVOCHECK	SFC behavior checking there is no dynamic overflow	x
DBG	step by step debugging	x
KVB	variable binding	x
VARLOCK	possibility to lock variable	x
HOTRESTART/ KERSYM	Hot restart feature (different of redundancy)	
WARNING	warning management	x

3. PACiS GATEWAY MANAGEMENT

3.1 Configuration management

The Configuration files are divided into two main parts:

- SBUS mapping (Station Bus),
- TBUS mapping (Telecontrol Bus).

The kernel reads the configuration file during the initialisation phase of the PACiS GTW application. It subscribes to SBUS predefined data, then runs as much Protocol DLL processes as defined in configuration and product definition (each protocol DLL is under license).

3.1.1 Configuration tool

To operate the PACiS GTW needs a configuration file or database. It is generated by PACiS SCE (System Configuration Editor). The generated database has a specific configuration version incremented when creating or updating the control system.

The database is a zip file that contains all data needed to operate the PACiS GTW. It is to be noticed that there is no on line settings or parameterisation of the PACiS GTW.

Details of the configuration process are described in the AP chapter.

3.1.2 Downloading tool

PACiS SCE provides a configuration file that has to be downloaded into the PACiS GTW possibly through SBUS Ethernet network. PACiS SMT (System Management Tool) is in charge of this operation.

Without database or in case of fault the PACiS GTW remains in a maintenance mode. PACiS SMT has the following features:

- to download a stand-by database,
- to switch stand-by database to operational one,
- to change by operator request the operating mode between maintenance and operational.

The transitions between modes are detailed in GTW_EN LG chapter.

3.2 Database management

The PACiS GTW has two databases, the current one (operational) and standby one (or reserved). New database is downloaded over the standby one without interrupting PACiS GTW normal behaviour.

Starting with a current database, PACiS GTW checks database coherency to its inner needs.

When SBUS communication starts, PACiS GTW checks communication data coherency between itself and other devices on IEC 61850.

It checks if IEC 61850 servers are present on Ethernet, if their database version and system revision are the same.

After the database compatibility checking it subscribes on SBUS network data to transmit to SCADA.

3.3 Time management

The data received from the SBUS servers are time stamped with UTC (Coordinated Universal Time). For protocols T101 and T104 data sent to the SCADA may be time stamped with PACiS GTW local time (which may be different than UTC). This choice is defined during the configuration step (available values "UTC" or "Local" for "time reference" attribute of the related protocol). For the others available SCADA protocols no change is made on the time stamping of the data sent to the SCADA.

PACiS GTW does not support SCADA synchronisation. Because several protocols can run simultaneously, this synchronisation can not be transmitted to SBUS.

3.4 Exploitation mode management

PACiS GTW is designed to medium and large substations where operator interfaces are often present at local room, or bay level. To avoid conflict between these control points, each control into the electric substation is subject to checking.

Three levels of checking are managed by the PACiS GTW:

- Remote/Local substation,
- SBMC mode,
- Taking control.

3.4.1 Substation Remote/Local mode checking

PACiS GTW checks the Local/Remote Substation mode to allow SCADA control only when control is configured for exploitation check and Substation is in Remote mode.

The Remote/Local bay mode is checked by the computer.

3.4.2 SBMC mode checking

When leading commissioning operation, a bay can be set in SBMC (Site Based Maintenance Control). Even if substation is in remote, any control received from SCADA and configured for SBMC is rejected to SCADA and not transmitted to the bay.

When a bay is set in SBMC (it means that some tests are running on it), the supervisory data from the bay can be configured to be filtered by PACiS GTW to the SCADA. Since and while the bay is in SBMC, its data are transmitted to a “suppress SBMC” state to its SCADA link avoiding to transmit non-significant events. Switching off the SBMC the SBMC data are transmitted to SCADA with their current value.

3.4.3 Taking Control

A specific SCADA control called “Taking Control” allows the SCADA to switch substation exploitation mode from Local to Remote and to take control on one SCADA port. Only controls received on this port will be accepted by PACiS GTW.

3.5 Redundancy management

PACiS GTW can have several kinds of redundancy into the system:

- Two identical PACiS GTWs,
- Redundant SBUS with special Ethernet switch (managed by the board),
- Redundant protocols on same PACiS GTW (identical or same protocol with separate dynamic data to transmit when asked by SCADA),
- Dual link protocol (same protocol and data on redundant link managed by SCADA).

Acquisitions of system information are sent simultaneously to the two PACiS GTWs. The SCADA is in charge of choosing the PACiS GTW it wants to communicate with.

4. COMMUNICATION LAYER

PACiS GTW has two different types of communications:

- Telecontrol Bus (TBus) to SCADA,
- Station Bus (SBus) to station

That can use different physical means.

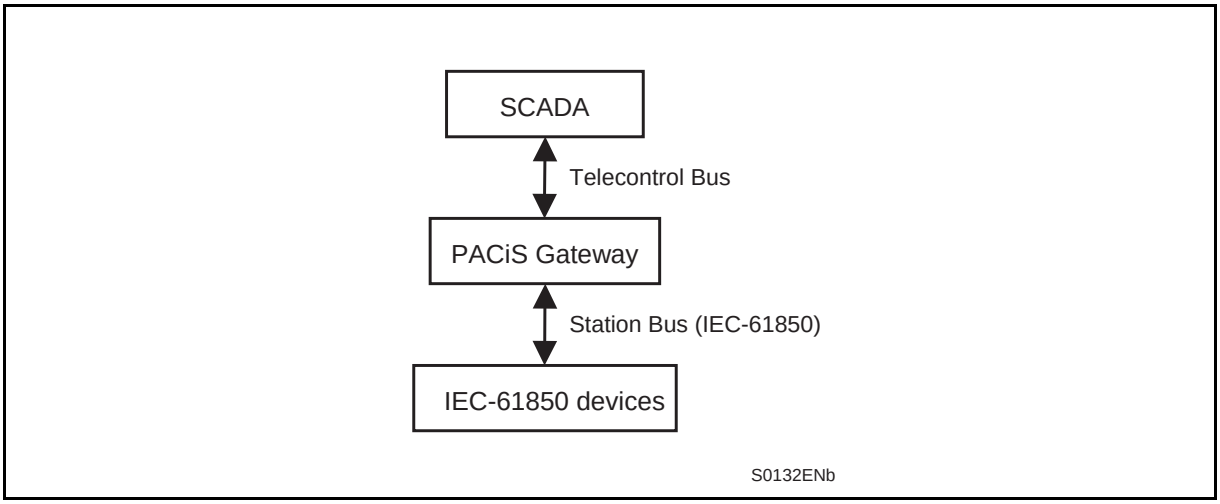


FIGURE 2: COMMUNICATIONS

4.1 Telecontrol bus

PACiS GTW behaves as a slave into master/slave protocol. The chapter CT gives the associate companion standard or supported function.

Protocols:

- GI-74
- IEC 60870-5-101 (T101)
- IEC 60870-5-104 (T104)
- ModBus MODICON
- DNP3
- CDC type II
- OPC (OLE for Process Control)
- IEC 61850
- T101-SAS

Link layer:

- RS 232
- Ethernet 10 or 100 Mbps for IEC 61850, T104 and OPC

Physical support:

- Copper (DB9 connector)
- Optical fiber (multimode or singlemode)

Number of communication links: up to four different protocols and up to 2 channels per protocol can be configured on a per PACiS GTW basis.

4.2 Station bus

PACiS GTW behaves mainly as a client of other IEC 61850 devices: MiCOM Computers, IEC 61850 IED, PACiS GTW.

Protocol:

- IEC 61850

Link layer: Ethernet 10 or 100 Mbps

Physical support: Copper twisted pair (RJ45 connector)

Number of communication links: one (an Ethernet DIN-rail switch can be used for redundancy Ethernet network).

4.3 Loss of communication

Refer to the FAQ in chapter GTW/EN MF (outside the scope of the Technical Guide).

5. SBUS ACQUISITION

If server is connected with the same database version the PACiS GTW subscribes to the data defined in its database.

5.1 IEC 61850 acquisition

The PACiS GTW acquires data from SBUS Ethernet network using only REPORT mechanism. The PACiS GTW does not translate GOOSE.

The REPORT acquisition done by the PACiS GTW gets:

- data value
- data state or quality attribute (validity and several kind of invalid state)
- time tag of last data value change
- time tag quality attribute (server synchronised or not when event occurs)

Data quality defines if data is valid or not: Unknown when disconnected, Saturated, Undefined. An Invalid quality attribute is translated to a specific SCADA invalid coding when correspondence exists.

Interested readers can refer to SII document for REPORT mechanism.

5.2 IEC 61850 supported Common Class

PACiS GTW can pick up the following kind of data or common class on IEC 61850. Their conversion to SCADA protocol is function of the protocol used (MODBUS MODICON has no mechanism for time tag transmission, unknown state on IEC 61850 is converted by IV bit set on T101…). The upper communication is detailed in protocol companion standard into the CT (Communication) chapter.

IEC 61850 information	Class	Comment
Single-point indication	SPS_ST,SPC_ST	With time tag, with quality attribute on DP on time tag
Double-point indication	DPS_ST,DPC_ST	With/without time tag
Integer indication	INS_ST,INC_ST	With/without time tag
Protection activation indication	ACT_ST	With/without time tag
Protection activation Phase indication	ACT_ST_Phs	Is managed in 5 SPS_ST With/without time tag
Directional Protection activation indication	ACD_ST	Is managed in 1 SPS_ST and 1 INS_ST With/without time tag
Directional Protection activation Phase indication	ACD_ST_Phs	Is managed in 5 SPS_ST and 5 INS_ST With/without time tag
Step position indication (transformers)	BSC_ST	With/without time tag
Measurement value (AI)	MV_MX WYE_MX DELTA_MX APC_MX	With/without time tag Type: digital, analogue, 1 among N Formats: floating point, scaled, normalised, integer
Integrated totals (counters) (Accl)	BCR_ST	With/without time tag
Single or double control	SPC_DPC_CO	Direct or Select/execute
Step position control (transformers)	BSC_CO	With/without time tag
Regulating step control	APC_SP	Direct or Select/execute

TABLEAU 1: DATA MANAGEMENT

5.3 IEC 61850 Controls

PACiS GTW supports Common Class expressed before (SPC_DPC_CO, BSC_CO, APC_CO). Basically it writes the corresponding control onto the server common class and waits control termination (possibly with NACK codes) to translate it to upper SCADA control termination.

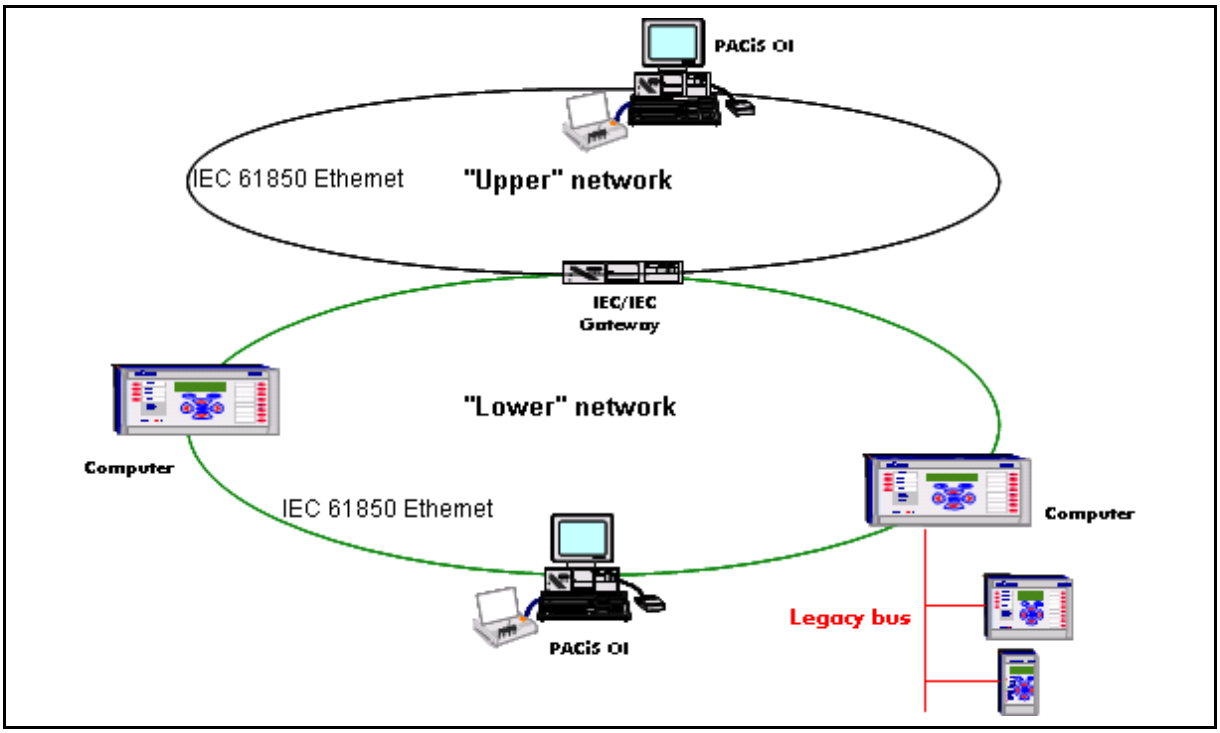
PACiS System defines Bypass controls on common control class by specific attribute. Bypass control has usually no equivalence on common SCADA protocol, also each bypass control that may need to be defined is treated as a specific protocol control. The PACiS GTW can manage only the synchrocheck bypass.

5.4 IEC61850/61850 PACiS GTW

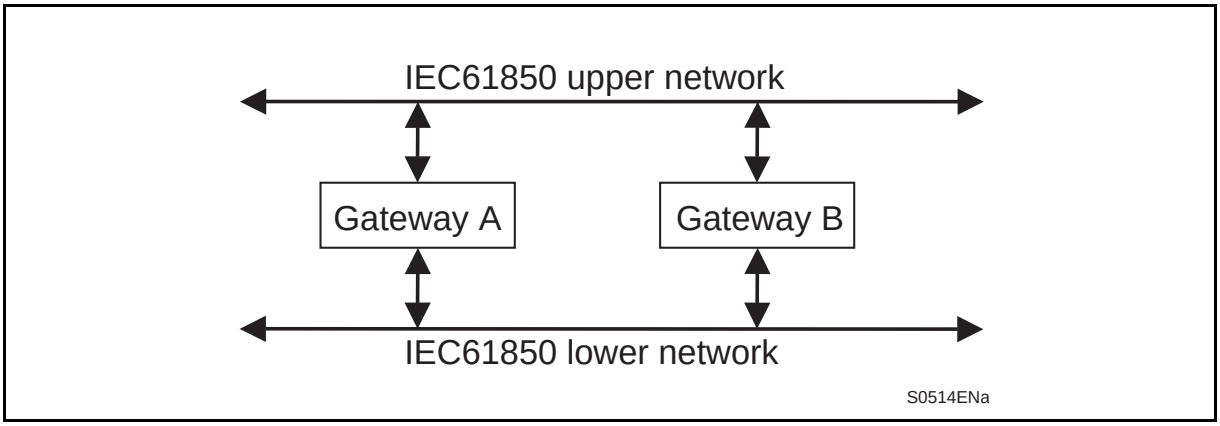
An IEC61850/IEC61850 PACiS GTW connects two IEC61850 station bus networks called the lower network and the upper network.

The following figure gives an example of such an architecture.

To configure the PACiS GTW , refer to the chapter GTW/EN AP.



5.5 Redundant IEC61850/IEC61850 PACiS GTW



An IEC61850/IEC61850 PACiS GTW can be duplicated. In this event, both PACiS GTWs have exactly the same configuration.

The main features of the management of this redundancy are:

- both PACiS GTWs perform the same acquisition on the lower network and send the same information to the upper network
- one PACiS GTW is master at one time: an IEC object (RedSt: Redundancy status) is set for a master PACiS GTW and reset for a slave PACiS GTW. The PACiS GTWs are servers of this object.
- an IEC61850 client on the upper network takes only into account information coming from PACiS GTW whose the RedSt is set. It sends controls only to this PACiS GTW.
- In event of failure of the master PACiS GTW, the other one becomes the new master PACiS GTW.
- In event of network failure (upper network or lower network), the current master PACiS GTW goes in Maintenance mode and the other PACiS GTW becomes the new master

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LEXICON

CONTENT

1. SCOPE OF THE DOCUMENT 3

2. LEXICON 4

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1. SCOPE OF THE DOCUMENT

This document is the last chapter of each PACiS documentation. It is the lexicon.

2. LEXICON

AC	Alternating Current
AccI	Accumulator Input
ACSI	Abstract Communication Service Interface Mapping from the standard IEC61850 abstract specification of communication service to a concrete communication infrastructure based on CORBA specific.
A/D	Analog/Digital
ADC	Analogue to Digital Converter
AE qualifier	Application Entity qualifier (Used internally by IEC61850 to identify a server Application)
AI	Analogue Input (Measurement Value including state attribute) Commonly Voltage or current DC signals delivered by transducers, and representing an external value (refer to CT/VT for AC).
AIS	Air Insulated Substation
AIU	Analogue Input Unit (Computer C264 Board name for DC Analogue Input)
Alarm	An alarm is any event tagged as an alarm during configuration phase
AO	Analogue Output Value corresponding to a desired output current applied to a DAC.
AOU	Analogue Output Unit (computer C264 board name for Analogue Output)
API	Application Programming Interfaces
AR	Auto-Reclose
ARS	Auto-Recloser
ASCII	American Standard Code for Information Interchange
ASDU	Application Specific Data Unit Name given in OSI protocol for applicative data (T103, T101..)
ASE	Applied System Engineering
ATCC	Automatic Tap Change Control Automation in charge of secondary voltage regulation, more specific than AVR
AVR	Automatic Voltage Regulator Automatism used to regulate secondary voltage by automatic tap changer control (see ATCC). Set of features can be added, see chapter C264 FT
Bay	Set of LV, MV or HV plants (switchgears and transformers) and devices (Protective, Measurement…) usually around a Circuit Breaker and controlled by a bay computer.
BCD	Binary Coded Decimal One C264 supported coding on a set of Digital Inputs, that determine a Digital Measurement, then Measurement value (with specific invalid code when coding is not valid). Each decimal digit is coded by 4 binary digits.
BCP	Bay Control Point Name given to the device or part used to control a bay. It can be Mosaic Panel, C264 LCD,… Usually associate with Remote/Local control.
BCU	Bay Control Unit Name given to the C264 in charge of a bay. Usually in contrast with Standalone
BI	Binary Input (or Information) Name given into Computer C264 of information already filtered, before it becomes an SPS, DPS… with time tag and quality attributes

BIU	Basic Interface Unit C264 Board for auxiliary power supply, watchdog relay, redundancy I/O
BNC	A connector for coaxial cable.
B-Watch	Monitoring and control device for GIS substation.
CAD	Computer Aided Design Computer application dedicated to design like wiring, protective setting…
CAS	CASe Computer C264 rack
CB	Circuit Breaker Specific dipole switch with capability to make line current and break fault current. Some have isolation capability (nominal-earth at each side)
CBC	Compact Bay Controller Small capacity bay computer for Medium Voltage applications typically C264C
CC	Complemented Contact
CCU	Circuit breaker Control Unit Computer C264 Board dedicated to switch control with 8DI, 4 DO
CDM	Conceptual Data Modelling Is the modelling of system/devices data using a hierarchy of structured data (called object of class) with their attributes, method or properties and the relations between themselves. It maps common data to devices or components of devices, with guaranty of interoperability.
Class	Define in IEC61850 as: description of a set of objects that share the same attributes, services, relationships, and semantics
Client	Define in IEC61850 as: entity that requests a service from a server and that receives unsolicited messages from a server
CM	CoMissioning
CMT	Computer Maintenance Tool
CO	Command, logic information Output (Functional Component) / Contact Open
COMTRADE	Common Format For Transient Data Exchange (international standard IEC 60255-24)
CPU	Central Processing Unit Computer C264 main Board based on PowerPC
CRC	Cyclic Redundancy Check Coding result send with packet of transmitted data to guarantee their integrity. Usually result of a division of transmitted data by polynomial.
CSV	Character Separate Values ASCII values separated by predefined character or string like in Excel or ASCII Comtrade.
CT	Current Transformer Basically the electric device connected to process and extracting a current measurement. By extension part of a device (C264) that receives AC values and convert it to numerical measurement value.
CT/VT (Conventional)	Current and Voltage transformers By extension, it is the C264 TMU board.
CT/VT (Non-Conventional or intelligent)	Current and Voltage transformers New generation of captor based for example on light diffraction under electric field, without transformer, that gives directly numerical measurement of voltage and current like communicating IED.

CSV	Character Separate Values Asci values separated by predefined character or string like in Excel or ASCII Comtrade.
DAC	Data Acquisition component of the GPT
DAC	Digital to Analogue Converter Used to generate analogue signals (usually DC) from a digital value.
DB	DataBase Tool or set of data that define all configuration of a system or specific device like computer. Opposed to setting or parameter DB has a structure that can not be modified on line. DB are always versioned.
DB-9	A 9-pin family of plugs and sockets widely used in communications and computer devices.
DBI	Don't Believe It Term used for undefined state of a double point when input are not complementary. DBI00 is state motion or jammed. DBI11 is undefined.
DBID	Databases Identity Brick
DC	Direct Current
DC, DPC	Double (Point) Control Two digit and/or relays outputs used for device control with complementary meaning (OPEN, CLOSE).
DCF77	External master clock and protocol transmission LF transmitter located at Mainflingen, Germany, about 25 km south-east of Frankfurt/Main, broadcasting legal time on a 77.5 kHz standard frequency.
DCO	Double Control Output
DCP	Device Control Point Located at device level (electric device or IED). It should have its own Remote/Local switch.
DCS	Digital Control System Generic name of system based on numeric communication and devices, to be opposed to traditional electrically wired control.
DCT	Double CounTer Counter based on 2 DI with complementary states (counting switchgear manoeuvre for example)
DE	Direct Execute
DELTA	Phase to phase delta values
Device	Term used for one of the following unit: Protective relays, metering units, IED, switchgear (switching device such as CB, disconnector or earthing switch), disturbance or quality recorders.
DHMI	C264 Display HMI
DI	Digital Input Binary information related to the presence or to the absence of an external signal, delivered by a voltage source.
DIN	Deutsche Institut für Normung The German standardisation body.
DIU	DC Input Unit Computer C264 Board name for Digital Input
DLL	Dynamic Link Library. Available on Windows XP. A feature that allows executable code modules to be loaded on demand and linked at run time. This enables the library-code fields to be updated automatically, transparent to applications, and then unloaded when they are no longer needed.

DM	Digital Measurement Is a measurement value which acquisition is done by DI and a specific coding BCD, Gray, 1 among N…
DNP3.0	Distributed Network Protocol DNP3 is a set of communication protocols used between components in process automation systems.
DO	Digital Output Used to apply a voltage to an external device via a relay, in order to execute single or dual, transient or permanent commands.
DOF	Degree Of Freedom Used for a template attribute, that can be modified or not when used. An attribute has a degree of freedom if a user can modify its values on its instances
DOU	Digital Output Unit Computer C264 Board name for Digital Output
DP	Double Point Information/control derived from 2 digital inputs/output; usually used for position indication of switching devices (OPEN, CLOSE).
DPC	Double Point Control
DPS	Double Point Status Position indication of switching devices (OPEN, CLOSE).
ECDD	Coherent Extract of Distributed Data
ECU	Extended Communication Unit. External module connected to the CPU board. This module converts non-insulated RS232 into optical signal or insulated RS485/RS422.
EH90	Transmission protocol dedicated to time synchronisation and standardised by EDF. Specification document: D.652/90-26c, March 1991.
EMC	Electro-Magnetic Compatibility
EPATR	Ensemble de Protection Ampèremétrique de Terre Résistante (French Legacy very resistive earth current module)
Event	An event is a time tagged change of state/value acquired or transmitted by a digital control system.
FAT	Factory Acceptance Test Validation procedures execution with the customer at factory.(i.e. SAT)
FBD	Functional Block Diagram One of the IEC61131-3 programming languages (language used to define configurable automation).
FIFO	First In First Out
FO	Fibre Optic
FP	Front Panel
FTP	Foil Twisted Pair
FLS	Fast Load Shedding
FSS	Force Suppress Substitute
Gateway	Level 6 session of OSI, the gateway is any device transferring data between different networks and/or protocol. The RTU function of the C264 gives a gateway behaviour to SCADA or RCP level. PACIS Gateway is separate PC base device dedicated to this function.
GHU	Graphic Human interface Unit Computer C264 Front Panel digital part (LCD, buttons, Front RS)
GIS	Gas Insulated Substation

GLOBE	GLOBE Brick
GMT	Greenwich Mean Time Absolute time reference
GPS	Global Positioning System Based on triangulation from satellite signal, that transmit also absolute GMT time used to synchronise a master clock
GOOSE	Generic Object Oriented Substation Event
GPT	Generic Protocol Translator software, supplied by ASE
Group	Logical combination of BI (i.e. SP, DP, SI or other groups).
GSSE	Generic Substation Status Event
Hand Dressing	Facility for an operator to set manually the position of a device (acquired by other means) from the HMI at SCP level; e.g. from OPEN to CLOSE (without any impact on the “physical” position of the electrical switching device).
HMGA	Horizontal Measurement Graphical Area
HMI	Human Machine Interface Can be PACIS OI (Operator Interface) or C264 LCD (Local Control Display) or Leds, mosaic...
HSR	High Speed auto-Recloser, first cycles of AR
HTML	Hyper Text Mark-up Language Used as standard for formatting web display
HV	High Voltage (for example 30kV to 150kV)
I/O	Input/Output
ICD	IED Capability Description
IEC	International Electro-technical Commission
IED	Intelligent Electronic Device General expression for a whole range of microprocessor based products for data collection and information processing
IP	Internet Protocol
IRIG-B	Inter-Range Instrumentation Group standard format B. This is an international standard for time synchronisation based on analogue signal.
JAMMED	Invalid state of a Double Point: Occurs when the 2 associated digital inputs are still in state 0 after an user-selectable delay, i.e. when the transient state “ motion ” is considered as ended
Kbus (Kbus Courier)	Term used for the protocol Courier on K-Bus network (kind of RS422).
LAN	Local Area Network
L-BUS	Legacy Bus Generic name of Legacy or field networks and protocols used to communicate between C264 (Legacy Gateway function) and IED on field bus. Networks are based on (RS232,) 422, 485. Protocols are IEC 60850-5-103 (T103 or VDEW), Modbus Schneider Electric or MODICON
LCD	Liquid Crystal Display or Local Control Display (on C264)
LD	Ladder Diagram, one of the IEC1131-3 programming languages (language used to define configurable automation).
LED	Light Emitting Diode
LF	Low Frequency
LOC	Local Operator Console

	Dedicated to maintenance operation
L/R	Local / Remote
Local / Remote Control Mode	When set to local for a given control point it means that the commands can be issued from this point, else in remote control are issue for upper devices.
LSB	Least Significant Bit
LSP	Load Shedding Preselection
LV	Low Voltage
MAFS	Marketing And Functional Specification
MC	Modular Computer
MCB	Mini Circuit Breaker. Its position is associated to tap changer.
MDIO	Management Data Input/Output A standard driven, dedicated-bus approach that is specified in IEEE802.3
Measurements	Values issued from digital inputs or analogue inputs (with value, state, time tag)
Metering (non-tariff)	Values computed depending on the values of digital or analogue inputs during variable periods of time (time integration).
Metering (tariff)	Values computed depending on the values of digital or analogue inputs during variable periods and dedicated to the energy tariff. These values are provided by dedicated “tariff computer ” which are external to the MiCOM Systems.
MIDOS	Schneider Electric Connector: Used for CT/VT acquisition
MMC	Medium Modular Computer
MMS	Manufacturing Message Specification (ISO 9506)
ModBus	Communication protocol used on secondary networks with IED or with SCADA RCP. 2 versions exist with standard MODICON or Schneider Electric one.
Module	Word reserved in PACIS SCE for all electric HV devices. It groups all switch-gears, transformer, motors, generators, capacitors, …
MOTION	Transient state of a Double Point Occurs when the two associated digital inputs are momentarily in state 0 (e.g. position indication when an electrical device is switching). The concept of “momentarily” depends on a user-selectable delay.
MPC	Protection Module for Computer
MV	Medium Voltage
MVAR	Mega Volt Ampere Reactive
NBB	Numerical Busbar Protection
NC	Normally Closed (for a relay)
NO	Normally Open (for a relay)
OBS	One Box Solution Computer that provides protection and control functions with local HMI. The prime application of this device is intended for use in substations up to distribution voltage levels, although it may also be used as backup protection in transmission substations. Likewise, the OBS may be applied to the MV part of a HV substation that is being controlled by the same substation control system.
OI	Operator Interface
OLE	Object Linking and Embedding OLE is a Microsoft specification and defines standards for interfacing objects.
OLTC	On Line Tap Changing

OMM	Operating Mode Management
OPC	OLE for process control OPC is a registered trademark of Microsoft, and is designed to be a method to allow business management access to plant floor data in a consistent manner.
Operation hours	Sum of time periods, a primary device is running under carrying energy, e.g. circuit breaker is in Close state and the current is unequal 0 A.
OSI	Open System Interconnection Split and define communication in 7 layers : physical, link, network, transport, session, presentation, application
OWS	Operator WorkStation (PACiS OI)
PACiS	Protection, Automation and Control Integrated Solutions
PLC	Programmable Logic Control /Chart. Includes PSL and ISaGRAF Within the PLC-programs are defined the configurable control sequences or automations taken into account by the MiCOM Systems.
POW	Point On Wave Point on wave switching is the process to control the three poles of an HV-circuit breaker in a way, to minimise the effects of switching.
PSL	Programmable Scheme Logic
PSTN	Public Switched Telephone Network
RCC	Remote Control Centre Is a computer or system that is not part of MiCOM system. RCC communicates with and supervises MiCOM system using a protocol.
RCP	Remote Control Point Name given to the device or part used to control remotely several bay or sub-station. Usually associated with Remote/Local sub-station control. It is a SCADA interface managed by the MiCOM system through Telecontrol BUS. Several RCPs can be managed with different protocols.
Remote Control Mode	When set for a control point it means that the commands are issued from an upper level and are not allowed from this point.
Remote HMI	Remote HMI is a client of the substation HMI server. The client may provide all or part of functions handled by the substation HMI.
RI	Read Inhibit This output indicates the availability of an analogue output (e.g. during DAC converting time)
RJ-45	Registered Jack-45 A 8-pin female connector for 10/100 Base-T Ethernet network
RMS	Root Mean Square
RRC	Rapid ReClosure
RSE	Régime Spécial d'Exploitation French grid function when works are being done on a HV feeder
RSVC	Relocatable Static Var Compensator
RS-232	Recommended Standard 232 A standard for serial transmission between computers and peripheral devices.
RS-422	A standard for serial interfaces that extends distances and speeds beyond RS-232. Is intended for use in multipoint lines.
RS-485	A standard for serial multipoint communication lines. RS-485 allows more nodes per line than RS-422
RSVC	Relocatabled Static Var Compensator

RTC	Real Time Clock
RTU	Remote Terminal Unit Stand alone computer that acquires data and transmit them to RCP or SCADA. Typically it is the C964. RTU link is the TBUS.
SAT	Site Acceptance Test Validation procedures executed with the customer on the site.
SBMC	Site Based Maintenance Control mode A bay in SBMC mode does not take into account the commands issued from RCP; moreover, some of its digital points & measurements (defined during the configuration phase) are not sent anymore to the RCP (they are "automatically" suppressed).
SBO	Select Before Operate A control made in two steps, selection and execution. Selection phase give a feedback. It can be used to prepare, reserve during time, configure circuit before execution. Controls are done into a protocol, or physical (DO select with DI Select then DO execute).
S-BUS	Station Bus, federal network between PACIS devices.
SCADA	Supervisory Control And Data Acquisition Equivalent to RCC
SCD	Description file extension (SCE)
SCE	System Configuration Editor
SCL	substation automation System Configuration Language (IEC 61850-6)
SCP	Substation Control Point Name given to the device or part used to control locally several bays or sub-station. Usually associated with Remote/Local sub-station control. It is commonly PACIS Operator Interface.
SCS	Substation Control System
SCSM	Specific Communication Service Mapping
SCT	Single Counter
SER	Sequence of Event Recorder Combines SOE with accurate Time synchronization and Maintenance facilities over Ethernet communication
Server	Define in IEC61850 as: entity that provides services to clients or issues unsolicited messages
Setpoints (analogue)	Analogue setpoints are analogue outputs delivered as current loops. Analogue setpoints are used to send instruction values to the process or auxiliary device
Setpoints (digital)	Digital values sent on multiple parallel wired outputs Each wired output represent a bit of the value. Digital setpoints are used to send instruction values to the electrical process or to auxiliary devices.
SFC	Sequential Function Chart One of the IEC1131-3 programming languages (language used to define configurable automation).
SI	System Indication Binary information that do not come from external interface. It is related to an internal state of the computer (time status, hardware faults…). It is the result of all inner function (AR, …), PSL, or ISaGRAF automation.
SICU 4	Switchgear Intelligent Control Unit Control unit of an intelligent circuit breaker (fourth generation)
SIG	Status Input Group
SINAD	Signal-plus-Noise-plus-Distorsion to Noise-plus-Distorsion ratio, in dB

SIT	Status Input Double Bit
SNTP	Simple Network Time Protocol
SOE	Sequence Of Events Other term for the event list.
SP SPS SPC	Single Point Single Point Status Single Point Control
ST	Structured Text An IEC1131-3 programming languages to define configurable automation
STP	Shielded Twisted Pair
Substation computer	Bay computer used at substation level
Suppression (Automatic)	A binary information belonging to a bay in SBMC mode will be automatically suppressed for the remote control. However changes of state will be signalled locally, at SCP
Suppression (Manual)	A binary information can be suppressed by an order issued from an operator. No subsequent change of state on a “suppressed information ” can trigger any action such as display, alarm and transmission
SWR	Switch Redundant Computer C264 board Ethernet switch with redundant Ethernet
SWU	Switch Unit (Computer C264 board Ethernet switch)
T101	Term used for IEC60870-5-101 protocol
T103	Term used for IEC60870-5-103 protocol
T104	Term used for IEC60870-5-104 protocol
TBC / TBD	To Be Completed / Defined
T-BUS	Telecontrol Bus, generic name of networks and protocols used to communicate between PACIS Gateway or C264 Telecontrol Interface function and the RCP. Networks are based on RS232, 485, or Ethernet (T104). Protocols are IEC 60850-5-101 (T101), Modbus MODICON
TC	True Contact
TCIP	Tap Changer in Progress
TCU	Transformer Current Unit Computer C264 CT/VT Board : Current acquisition
TDD	Total Demand Distorsion, similar to the THD but applied to currents and with a rated current (I_n) as reference
TG	Telecontrol Gateway
THD	Total Harmonic Distorsion, sum of all voltage harmonics
TI	Tele Interface
TM	Analogue Measurement
TMU	Transducerless Measurement Unit
Topological interlocking	Interlocking algorithm, based on evaluation of topological information of the switchgear arrangement in the HV network, the switchgear kind and position, & defined rules for controlling this kind of switch (e.g. continuity of power supply)
TPI	Tap Position Indication (for transformers). Frequently acquired via a Digital Measurement
TS	Logic position
TVU	Transformer Voltage Unit (computer C264 CT/VT Board : Voltage acquisition)

UCA	Utility Communications Architecture Communication standard (mainly US) used for PACIS SBUS communication
UPI	Unit Per Impulse Parameter of counter to convert number of pulse to Measurement value. Both data (integer and scaled float) are in common class UCA2 Accumulator.
UTC	Universal Time Co-ordinates (or Universal Time Code) Naming that replace GMT (but it is the same)
VdBS	Versioned data Base System, databag generated by SCE & ready to download
VDEW	Term used for IEC60870-5-103 protocol
VMGA	Vertical Measurement Graphical Area
Voltage level	Set of bays whose plants & devices are dealing with same voltage (e.g. 275kV)
VT	Voltage Transformer Basically the electric device connected to process and extracting a voltage measurement. By extension part of a device (C264) that receives this AC value and convert it to numerical measurement value. VT are wired in parallel.
WTS	Windows Terminal Server, Microsoft’s remote desktop connection
WYE	Three phases + neutral AI values

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